INSTRUCTION MANUAL

EMR MODEL 4130
SUBCARRIER DISCRIMINATOR
Including
EMR MODEL 4130-M7 &
EMR MODEL 4131-12-M8

EMR TELEMETRY
BOX 3041 • SARASOTA, FLORIDA 33578

ME-6231

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ADDENDUM

EMR MODEL 4130-M7 SUBCARRIER DISCRIMINATOR

A.1 GENERAL

This addendum describes the M7 configuration of the EMR Model 4130 Subcarrier Discriminator. The M7 configuration is functionally the same as a standard unit except for the following:

a. An output line from the bandpass input filter is routed to the unit output connector.

b. An offset network is added which provides a fixed +3.0-volt offset at the unit data output.

A description of the changes required for the M7 configuration is provided in paragraph A.2. All other information pertinent to the 4130-M7 is contained in the standard 4130 instruction manual.

A.2 DESCRIPTION

A.2.1 Bandpass Input Filter Output

A connection is added from the bandpass input filter output, J2 pin 6, (ref. Figures 5-8 and 7-2) to the unit output connector, J1 pin 10. A resistor is included in series with the output line. This resistor is described as follows:

RESISTOR, 430Ω ±5%, 1/4W;
EMR STOCK NO. 616-02-43009;
MFGR. CODE 01121;
MFGR. PART NO. RC07GF431J.

The physical location of the added resistor is shown in Figure A-1.

A.2.2 Offset Network

An offset network is included on the Model 4136 Output Amplifier Card. This network consists of the following components (ref. Figure A-3 which replaces Figure 5-7 of the 4130 instruction manual):

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.
C12	CAPACITOR, 0.1 μF ±20%, 50V	301-13-10002	72982	8131-050-651-104M
CR8	DIODE, Ref., 6.2V	088-97-08230	04713	1N823
R29	RESISTOR, 36.5K ±1%, 1/10W	608-09-36501	06141	624
R31	RESISTOR, 34.8K ±1%, 1/10W	608-09-34801	06141	624
R32	POTENTIOMETER, 5K ±30%, 1/2W	201-98-00093	73138	62PR5K
R33	RESISTOR, 1.5K ±5%, 1/4W	616-02-15000	01121	RC07GF152J

The physical location of the components on the Output Amplifier Card is shown in Figure A-2 along with all other Output Amplifier Card components.

Three terminals, E1/E2/E3, are included in the network which are used to connect the offset network to the amplifier input. If E1 is jumpered to E3, the network is not connected and the unit operates as a standard unit with no offset. When E1 is jumpered to E2, the offset network is connected to the amplifier input which offsets the amplifier to approximately +3 volts. Potentiometer R32 is used to set the offset voltage as desired.

When a center frequency subcarrier is input to the unit and the offset network connected, the front-panel BALANCE control is used to set the output voltage at 3 volts. The output voltage is adjustable from 0.2V peak-to-peak to 10 volts peak-to-peak as set at the front-panel BE VOLTS control.

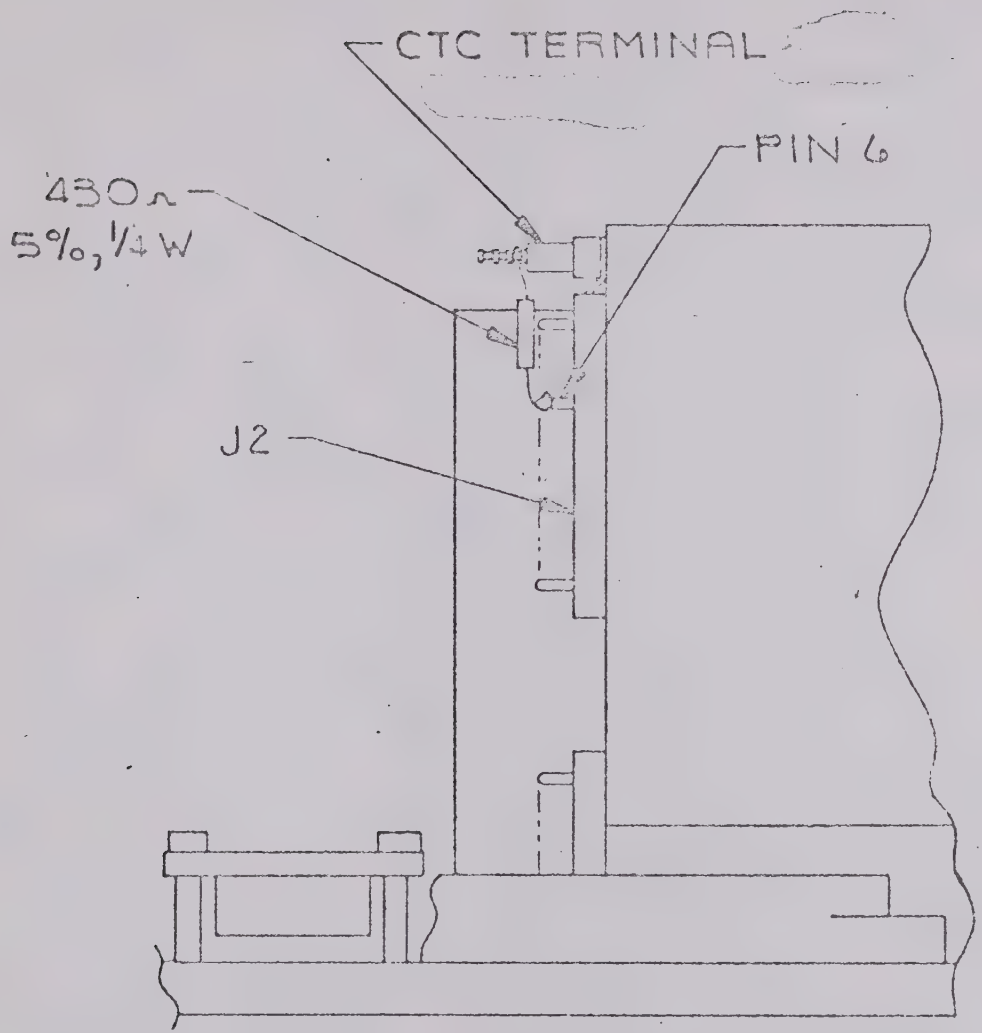

Figure A-1. Added Resistor Location Diagram

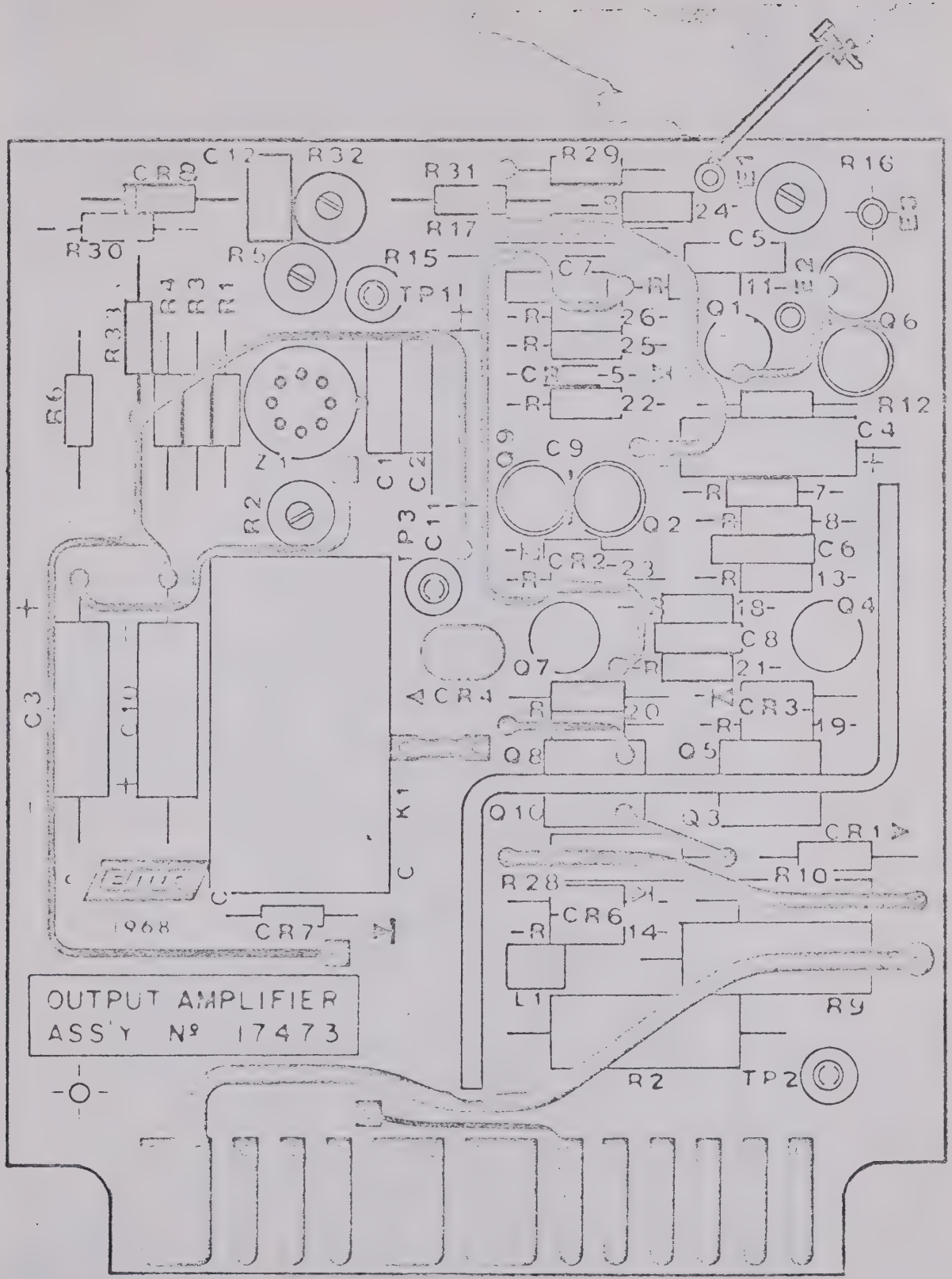

Figure A-2. Output Amplifier Card Assembly Diagram

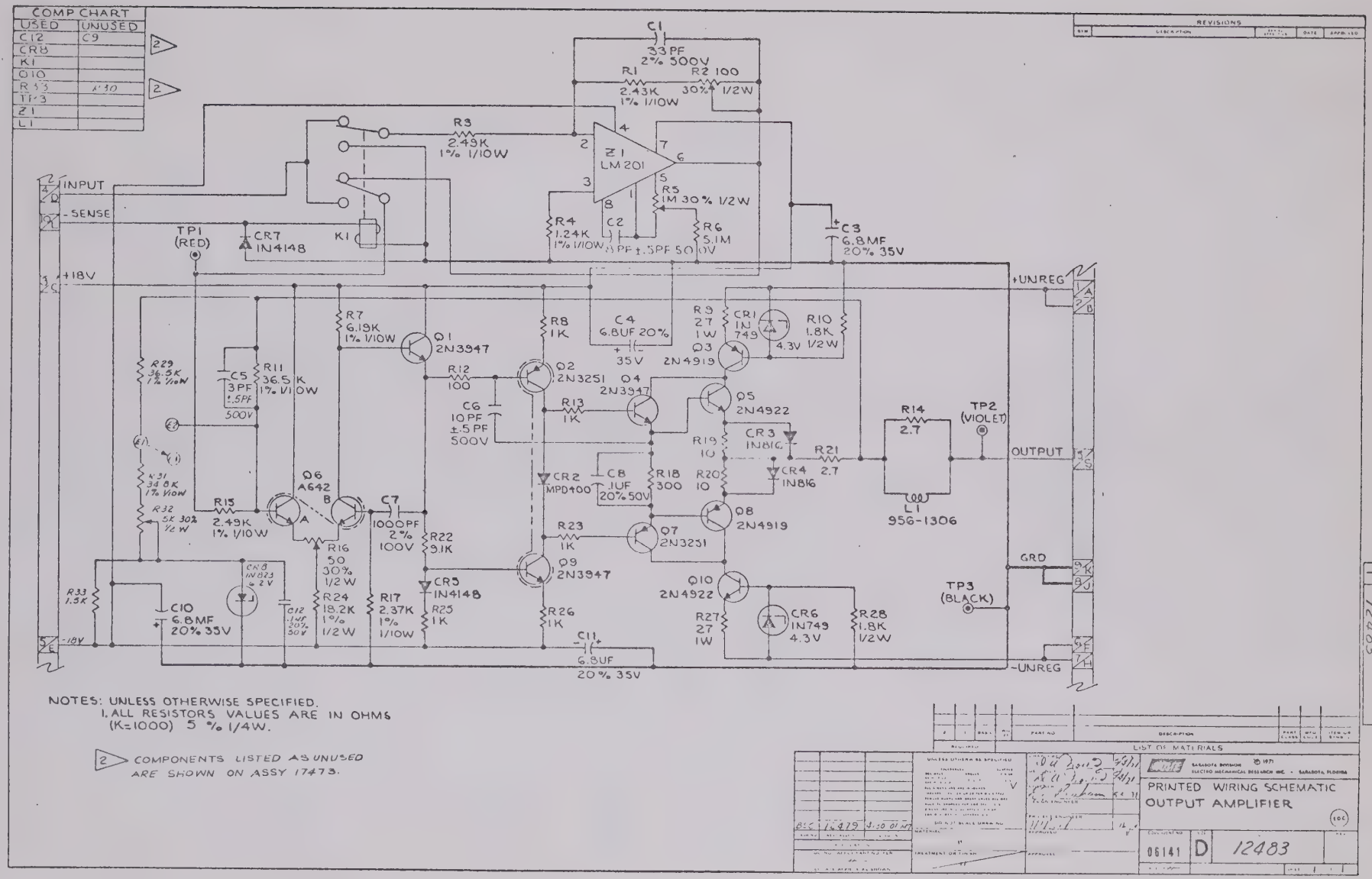

Figure A-3. Output Amplifier Card Schematic Diagram

THIS MANUAL FOR THE
FOLLOWING UNITS

MODEL 4130	MODEL 4131	MODEL 4137
S/N 442 and up	S/N 218 and up	S/N 653 and up

August 1971

SUPPLEMENT

EFFECTIVITY: EMR 4130 Subcarrier Discriminator.

DESCRIPTION: When the EMR Model 4137 Output Filters are used independent of the EMR Model 4130 Basic Unit, the 4137 input must be driven by a source with a 1 kΩ (±5%) impedance.

October, 1970

MANUAL CHANGE NOTICE #1

EFFECTIVITY: Models 4131-51, 4131-52, and 4131-59 Reference Channel Selectors, serial numbers 360 and up.

DESCRIPTION: Capacitor C8 is changed to 20 Pf ±0.5 Pf, 500V, EMR STOCK NO. 304-01-02009, MANUFACTURER CODE 06141, MANUFACTURER PART NO. 600.

April 1971

MANUAL CHANGE NOTICE #2

EFFECTIVITY: Model 4130 Subcarrier Discriminator, serial number 445 and up.

DESCRIPTION: Two changes are made to the 4130 as of the above serial numbers. These are described as follows --

a. Resistor R2 on the subchassis assembly (ref. Figure 5-8 and Table 6-2) is changed to the following:

RESISTOR, 7.32K ±1%, 1/8W;
EMR STOCK NO. 605-09-73200;
MFGR. CODE 06141;
MFGR. PART NO. 625.

b. A capacitor, C1, is added between rear connector (ref. Figure 5-8) J1 pin 7 and fuse F1, pin 2. This capacitor is described as follows:

CAPACITOR, 0.22 μF ±20%, 600V;
EMR STOCK NO. 383-15-22002;
MFGR. CODE 14655;
MFGR. PART NO. MPY-6P22.

January 1972

MANUAL CHANGE NOTICE #3

EFFECTIVITY: Model 4130 Subcarrier Discriminator, serial number 510 and up.

DESCRIPTION: The front panel IN and % BE Meter types are changed. Also, certain components are changed to ensure proper operation of the meters. These changes are listed as follows --

a. % BE Meter, M1, (ref. Table 6-2) is an EMR STOCK NO. 170-99-00034; MFGR. CODE 06141; MFGR. PART NO. 21441-2.

b. IN Meter, M2, (ref. Table 6-2) is an EMR STOCK NO. 170-99-00033; MFGR. CODE 06141; MFGR. PART NO. 21441-1.

c. Resistor R2 on the Subchassis Assembly (ref. Table 6-2 and Figure 5-8) is changed to a test variable.

d. Front Panel Assembly (ref. Table 6-2) is changed to EMR STOCK NO. 191-89-00432; MFGR. CODE 06141; MFGR. PART NO. 8823-1.

e. Limiter Card resistors R37 and R41 (ref. Figure 5-3 and Table 6-3) are changed to the following:

R37 -- RESISTOR, 470Ω ±5%, 1/4W;
EMR STOCK NO. 616-02-47009;
MFGR. CODE 01121;
MFGR. PART NO. RC07GF471J.

R41 -- RESISTOR, 1K ±5%, 1/4W;
EMR STOCK NO. 616-02-10000;
MFGR. CODE 01121;
MFGR. PART NO. RC07GF102J.

April 1971

MANUAL CHANGE NOTICE #4

EFFECTIVITY: Model 4131 Channel Selectors, serial number 674 and up.

DESCRIPTION: Deviation sensitivity select resistors are changed from frequency and deviation variables (or fixed resistors in the case of the Reference Channel Selectors) to test variables. The resistor designations for the various channel selectors are as follows --

Models 4131-01, -02, -03, -04, -11, -12, -13, and -14: R58 and R64.

Models 4131-51, -52, and -59: R17 and R27.

Model 4131-61: R33 and R34.

January 1972

MANUAL CHANGE NOTICE #5

EFFECTIVITY: Model 4130 Output Amplifier Card Assembly, serial number 1 and up.

DESCRIPTION: Capacitor C2 on the card is changed to the following (ref. Figure 5-7 and Table 6-5) --

C2 -- CAPACITOR, 5 pf ±0.5 pf, 500V;
EMR STOCK NO. 304-01-00509;
MFGR. CODE 06141;
MFGR. PART NO. 600.

The value of this capacitor may be increased should testing of the unit require a change.

January 1972

MANUAL CHANGE NOTICE #6

EFFECTIVITY: Model 4130 Reference Discriminator.

DESCRIPTION: When using a Model 4130 as a reference discriminator (with a Model 4130-50-Series Channel Selector), the front-panel BE VOLTS control should be set so that the discriminator output at a bandedge of the reference channel is 10 volts peak. This setting will yield optimum tape-speed improvement for most applications. For more precise requirements, a static or dynamic test may be performed to set the BE VOLTS control.

In a reference discriminator configuration, the wiring at the BE VOLTS control differs from a data discriminator. This wiring change is made automatically when a reference channel selector is installed in the unit. The wiring change occurs at the output side of the BE VOLTS control. In a data discriminator, the BE VOLTS control is terminated to ground. This is not true for a reference discriminator. The output side of the control is not terminated (ref. Figure 7-12). Therefore, the output voltage of a reference discriminator is not adjustable over the same range as a data discriminator. The output voltage is a direct function of the deviation in the reference subcarrier channel. The bandedge voltages of the reference discriminator are adjustable in the range of ±9 to ±11 volts only.

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Dates of issue for basic and revisions are:

Basic	March 1968
Revision A	October 1968
Revision B	October 1968
Revision C	February 1969
Revision D	April 1969
Revision E	December 1969
Revision F	November 1970
Revision G	April 1971
Revision H	July 1971

Total number of pages in this manual is 153 consisting of the following:

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*iii thru vi	H	5-10	A
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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual contains information describing the EMR 4130 Subcarrier Discriminator. The 4130 uses a building-block approach in forming various discriminator configurations. Included normally in the 4130 is a Model 4130 Basic Unit, a Model 4131 Channel Selector, and a Model 4137 Output Filter. The Models 4131 and 4137 are plug-in type units which are designed for installation in the Model 4130 Basic Unit.

Two basic types of discriminators are formed by combining the various units, a data discriminator or a reference discriminator. A data discriminator normally consists of a Model 4130 Basic Unit, a Model 4131 Channel Selector, and a Model 4137 Output Filter. A reference discriminator consists of a Model 4130 Basic Unit and a Model 4131-50-Series Reference Channel Selector. Since the Model 4130 Basic Unit is common to all configurations and because of the many channel selector/output filter types, Sections 1 through 6 of this manual primarily describe the basic unit with only general information pertinent to the channel selectors and output filters. Detailed information for common types of channel selectors and output filters is contained in Sections 7 and 8, respectively. Special types of channel selectors and output filters are described in appendices which are included in this manual when required. See Section 2 for a complete list of 4130 equipment.

1.2 FUNCTIONAL DESCRIPTION

The 4130 in a data discriminator configuration is designed for use in a data reduction system to detect intelligence information contained in a subcarrier channel. Operation on subcarrier channel center frequencies between 300 Hz and 2 MHz with deviations from ±2.5% to ±45% is enabled through the use of interchangeable channel selectors. Output data cutoff frequencies between 3 Hz and 450 KHz and switchable response characteristics are provided by interchangeable output filters. Front panel displays provide a visual indication of the subcarrier signal input level and amount of deviation occurring in the subcarrier channel. Front panel controls provide a means of selecting positive or negative deviation sensitivity and of adjusting the data output voltage for bandedge-to-bandedge deviation in the subcarrier channel.

A simplified block diagram of the 4130 data discriminator is shown in Figure 1-1. The channel selector and output filter are shown for reference only. Circuit information concerning these units is contained in Sections 7 and 8 of this manual or in appendices included for specialized equipments.

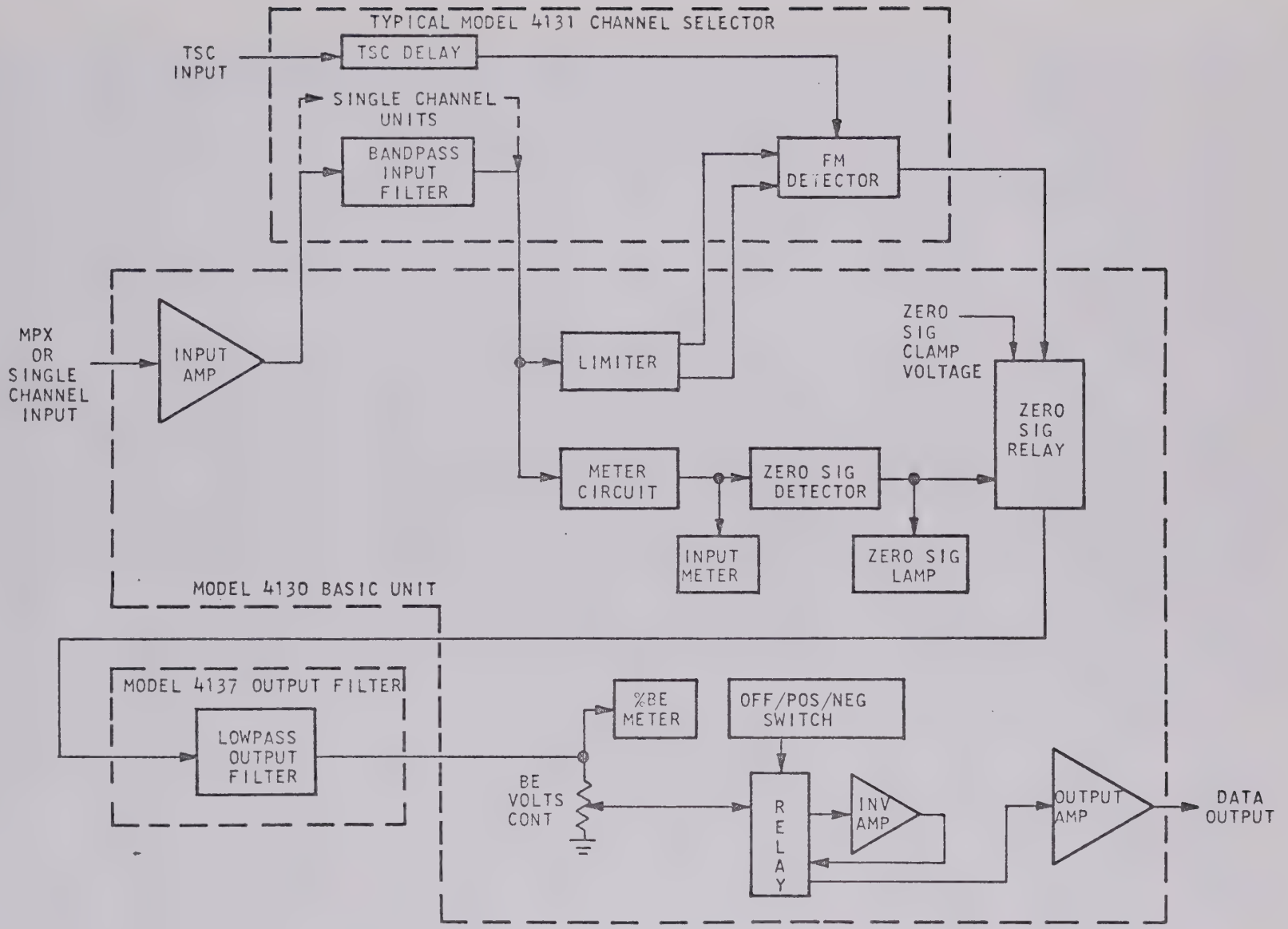


Figure 1-1. Model 4130 Subcarrier Discriminator Simplified Block Diagram

The Model 4130 Basic Unit contains circuitry necessary for discriminator operation which is not involved with establishing the center frequency, deviation, or data response parameters. Subcarrier channel center frequency and deviation parameters are established by plug-in type Model 4131 Channel Selectors.

Several data channel selector configurations are available for single channel and multiplex operation and in calibrating versions. These channel selectors are outlined and identified in Table 2-3. The reference channel selectors are listed in Table 2-4. Switchable frequency channel selectors are identified in Table 2-4A.

The subcarrier signal output of the BPIF is limited and amplified by a pluse-shaping limiter circuit providing a square-sided subcarrier signal output to the FM detector. The FM detector is either a pluse-averaging circuit or a phase-locked loop circuit depending upon the particular channel selector installed in the unit.

A zero signal relay either couples the detector output to the output filter or interrupts the normal signal path and couples a pre-established voltage level to the output filter, depending upon the subcarrier signal amplitude at the BPIF output. If the subcarrier signal amplitude is sufficiently low so as to result in erroneous data, the zero-signal detector recognizes this condition and energizes the zero-signal relay. For this condition, the normal data path is interrupted and a zero-signal clamp voltage is coupled to the output filter.

The output filter is contained normally in a plug-in Model 4137 Output Filter. Several output filter configurations are available providing various data cutoff frequencies, rolloff characteristics, and response characteristics. Data cutoff frequencies between 3 Hz and 450 KHz can be provided in 3-, 5-, or 7-pole filter configurations with 18 Db, 30 Db, or 42 Db asymptotic rolloff characteristics. Filters also have switchable response characteristics. (A list of available output filters is contained in Table 2-5.) Certain Model 4131 Channel Selectors contain a built-in output filter and require no 4137 for operation. However, in either case, the output filter function is the same.

The output filter output is a data signal representative of the modulation component contained in the subcarrier channel. This data signal is displayed on the % BE meter in the form of percentage deviation from band center of the subcarrier channel. The voltage magnitude of the data signal available at the discriminator output is adjusted at a bandedge volts control. The voltage level established at this control is coupled through a relay to the output amplifier or is inverted by the inverting amplifier and then routed to the output amplifier. The particular signal patch is selected by the POS or NEG deviation sensitivity postions of the front panel switch.

An internal power supply operates from a primary AC power input to generate all voltages necessary for operation of the 4130. The 4130 is available for use with various primary power inputs. The available units are outlined in Table 2-2.

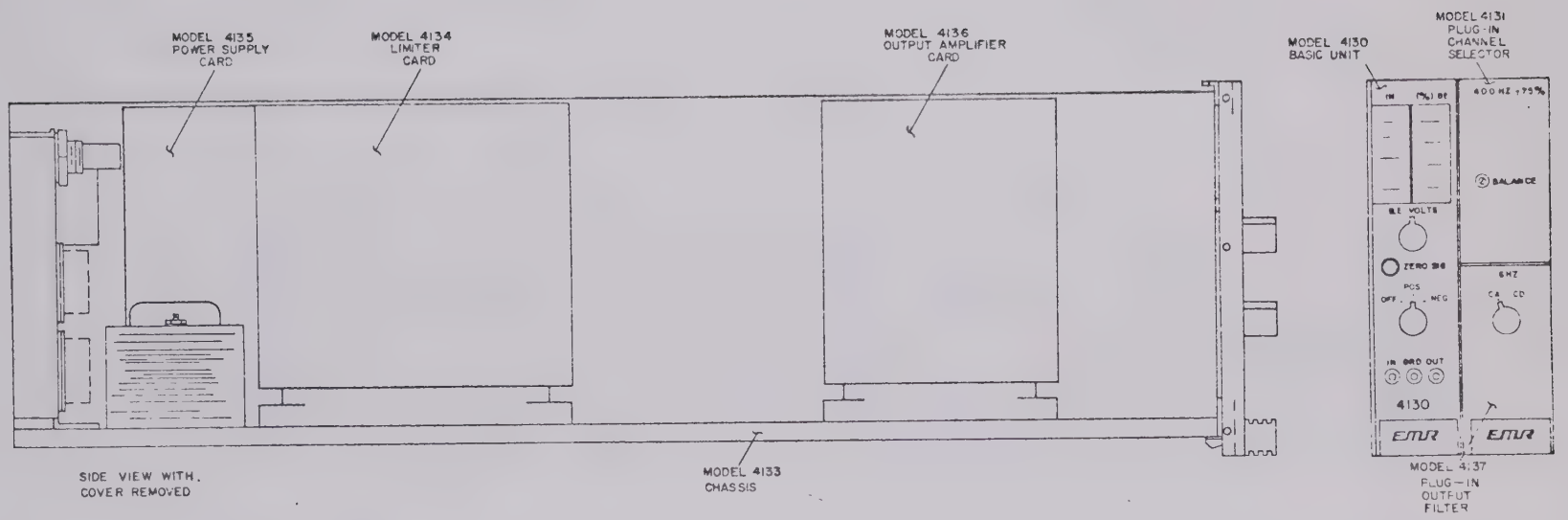
1.3 PHYSICAL DESCRIPTION

The 4130 is a modular unit designed for mounting in an EMR Model 4005 Rack Adapter. Overall dimensions of the 4130 are listed in the mechanical specifications in Section 2 of this manual. Included normally in the 4130 data discriminator is a Model 4130 Basic Unit, a Model 4131 Channel Selector, and a Model 4137 Output Filter. The channel selector and output filter are plug-in type units which are mounted in the basic unit. Typical units for a data discriminator are illustrated in the top assembly diagram, Figure 1-2. Refer to Sections 7 and 8 for detailed channel selector and output filter information.

1.4 TEST ADAPTER

An EMR Model 4608 Test Adapter is available for use in extending the 4131 and 4137 plug-in units from the 4130 Basic Unit. This test adapter, shown in Figure 1-3, occupies both plug-in locations of the 4130 Basic Unit. Two plugs are located on the rear of the test adapter which plug into the 4130 Basic Unit internal receptacles. The plug-in units are then inserted into the test adapter which contains two front-mounted receptacles for mating with the plug-in units' rear connectors.

To obtain this test adapter, specify EMR Model 4608 Test Adapter on the order form.



DWG. CONTROL NO. 4130-102

Figure 1-2. EMR 4130 Assembly Diagram

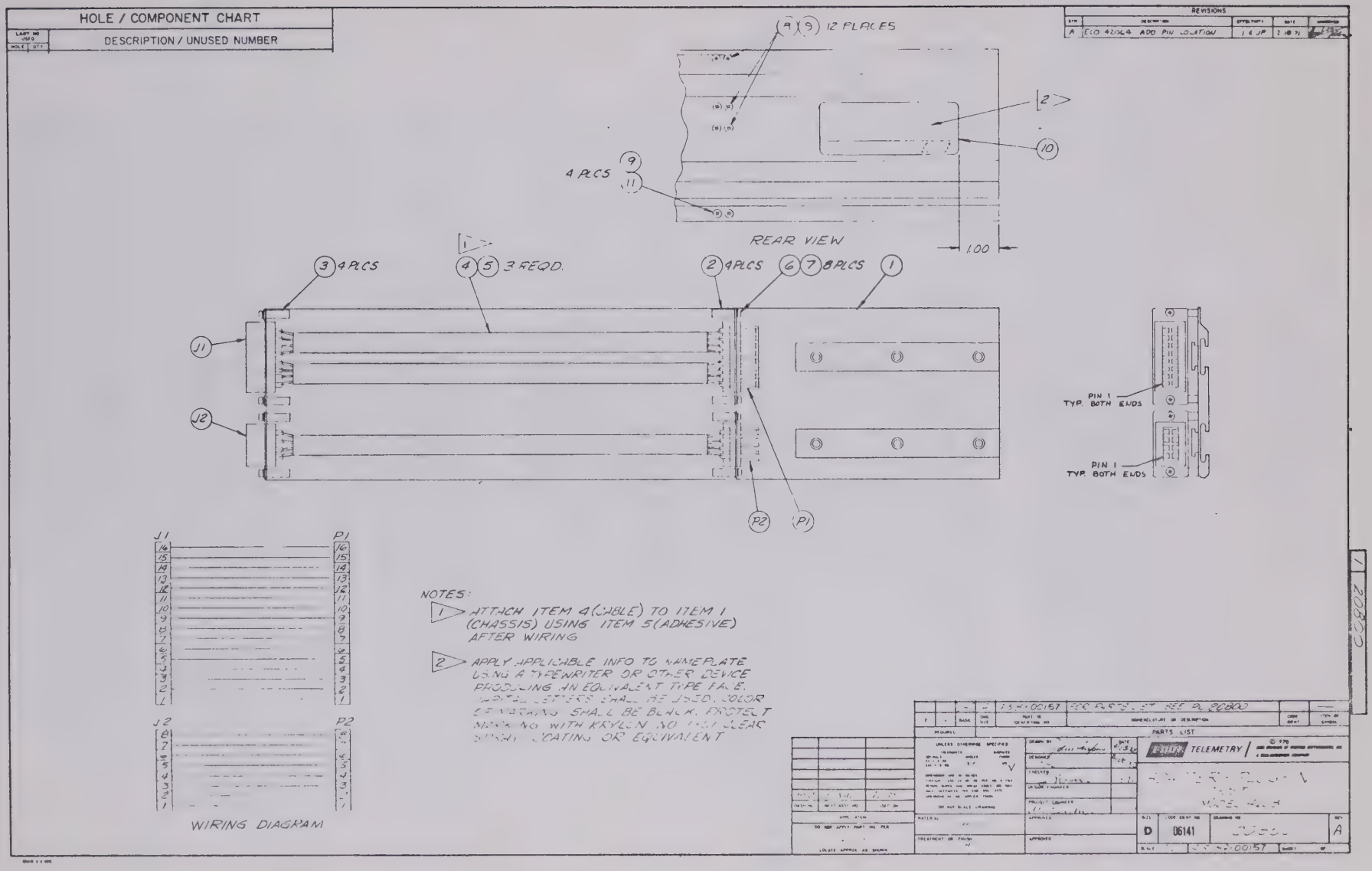


Figure 1-3. EMR Model 4608 Test Adapter

SECTION 2

SPECIFICATIONS

2.1 GENERAL

This section contains the electrical and mechanical specifications for the EMR 4130 Data Subcarrier Discriminator. These specifications are outlined in paragraphs 2.1 and 2.2. When the 4130 is used as a reference discriminator or switchable channel unit, certain specifications are modified. These specification changes are described in the appropriate paragraphs of Section 7 or in appendices of this manual.

Also included in this section is a list of the integral equipments of the 4130 discriminator and part number identification for these equipments. This information is provided in Tables 2-2 through 2-5.

2.2 ELECTRICAL SPECIFICATIONS

The specifications as outlined in this paragraph are based upon using the 6-pole pair bandpass input filter configuration (Model 4131-01). Certain specifications are degraded or not applicable for other Model 4131 Channel Selectors.

a. Subcarrier Channel Center Frequencies: Any frequency between 300 Hz and 2 MHz as established by the Model 4131 Channel Selector. This frequency is stamped on the front panel of the channel selector. Several versions of the Model 4131 are available. These units are described in tables at the end of this section.

b. Center Frequency Deviations: Any deviation from ±2.5% through ±45% as established by the Model 4131 Channel Selector. The deviation is stamped on the front panel of the channel selector.

c. Input Impedance: Not less than 1 megohm shunted by not more than 40 picofarad.

d. Dynamic Input Signal Range: 2 millivolts RMS through 5 volts RMS at center frequencies not more than 300 KHz. 5 millivolts RMS through 5 volts RMS at center frequencies from 300 KHz through 2 MHz.

e. Amplitude Modulation Rejection: The output transient is not more than 0.3% of full bandwidth for a 20 Db step change (occurring anywhere within the input signal range) in subcarrier amplitude at center frequency with a modulation index of 5.

f. Unwanted Signal Rejection: A subcarrier signal located at 3 times the normal channel deviation is down not less than 21 Db in an IRIG CBW system and not less than 26 Db in an IRIG PBW system when measured at the output of the bandpass filter.

g. Tape-Speed Compensation: Tape-speed improvement for wow and flutter variations as great as ±3%, up to channel cutoff frequency, is no less than 33 Db at a modulation index of 5 and no less than 23 Db at a modulation index of 2.

h. Data Cutoff Frequencies: Any frequency from 3 Hz through 450 KHz as determined by the Model 4137 Output Filter. This frequency is stamped on the front panel of the output filter.

i. Output Filter Response Characteristics: The output filter response characteristics are established by the Model 4137 Output Filter. The standard output filters available are a 5-pole and a 7-pole, switchable CA-CD unit. Other output filter configurations are available on special request. All 4137 Output Filters are listed in Table 2-5.

j. Harmonic Distortion: (See Table 2-1.)

k. Noise: (See Table 2-1.)

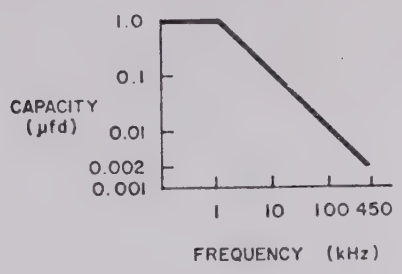
l. Nonlinearity: (See Table 2-1.)

m. Output Voltage and Current: Voltage is adjustable between ±0.1 and ±10.5 volts for normal operation; ±100 milliamperes to 450 KHz. A short-circuit output will not damage the unit. Output current is limited to 130 milliamperes.

n. Output Polarity: Negative or positive deviation sensitivity is selectable.

o. Output Impedance: Less than 1 ohm to 10 KHz; less than 10 ohms to 450 KHz.

p. Output Capactive Loading Capability:



q. Output Zero Stability: Zero drift not greater than ±0.1% of full bandwidth in 15 hours after a 15-minute warmup. Temperature coefficient of zero drift is no greater than ±0.01% of FBW/°C for deviations $\geq$ ±5%.

r. Output Sensitivity Stability: Not greater than ±0.05% of full bandwidth in 15 hours after a 15-minute warmup.

s. Line Voltage Sensitivity: A 10-volt step of line voltage anywhere between 105 to 132 volts AC causes a peak transient of no more than 0.1% of bandwidth at the discriminator output and no more than 0.05% change in output zero.

t. Power Requirement: 105 to 132V RMS, 47 to 65 Hz, single phase (20 watts at full load); 105 to 132V RMS, 360 to 440 Hz; 230V ±10%, 47 to 63 Hz. (See Table 2-2 for power input identification.)

.3 MECHANICAL SPECIFICATIONS

a. Panel Size: 5-1/4 inches (13.3 Cm) high by 2-7/8 inches (6.18 Cm) wide.

b. Depth: 16-3/4 inches (42.5 Cm) to rear of unit (excluding projections from front panel).

c. Weight: Complete discriminator including plug-in modules--Net, 7 pounds 4 ounces (3.3 Kg); shipping, 9 pounds 4 ounces (5.1 Kg).

d. Mounting: The EMR 4130 including plug-in modules is designed for mounting in an EMR Model 4005 Rack Adapter. Up to seven complete units may be mounted in a single rack adapter. The rack adapter is intended for installation in a standard 19-inch equipment rack.

e. Panel Finish: Various semi-gloss baking enamel colors and letter combinations are available. (See Table 2-2 for paint color information.)

Table 2-1. Harmonic Distortion, Noise, and Nonlinearity Specifications

Output Specification	Center Frequency: 300 Hz ⟶ 300 KHz ⟶ 2 MHz		MI	Deviation	Comments
Harmonic Distortion	≯ 0.8%	≯ 1.0%	2	- - - -	At any data frequency up to the channel cut-off frequency using a 6-pole pair linear-phase bandpass input filter.
	≯ 0.3%	≯ 0.5%	5	- - - -	
Noise	≯ 0.05% RMS of full bandwidth and 50 mv p-p at 20V p-p.		2	≯ ±15%	Valid at any setting of Bandedge Volts control and anywhere within the input signal range when using a 5- or 7-pole constant delay low-pass output filter.
	≯ 0.02% RMS of full bandwidth and 20 mv p-p at 20V p-p.		5	≯ ±15%	
		≯ 0.05% RMS of full bandwidth and 50 mv p-p @ 20V p-p.	5	> ±15%	
Nonlinearity	≯ 0.03% of full bandwidth, best straight line.	≯ 0.1% of full bandwidth, best straight line (up to 1.5 MHz). Above 1.5 MHz, ≯ 0.3%.		≯ ±16%	
	≯ 0.1% of full bandwidth, best straight line.	≯ 0.3% of full bandwidth, best straight line.		±16% to ±45%	

>Greater than; ≯Not greater than.

Table 2-2. Part Number Identification, Model 4130 Basic Unit

MODEL 4130 - XX - X

These digits identify the primary AC power required for operation. The power inputs and identifying numbers are as follows:

01 -- 105 to 132 volts RMS, 47 to 65 Hz.

71 -- 105 to 132 volts RMS, 360 to 440 Hz.

81 -- 230 volts RMS ±10%, 47 to 63 Hz.

These digits identify the paint colors and lettering combinations available. The paint colors and identifying numbers are as follows:

1 -- light green (00048W) with white lettering.

2 -- dark green (00049W) with white lettering.

4 -- grey (26492B) with black lettering.

9 -- Special color and lettering combinations.

Table 2-3. Part Number Identification, Model 4131 Data Channel Selector

MODEL 4131-XX-XXXX.XXX-±XXX.XX-XX

These digits identify the bandpass input filter configuration and deviation limits. The types of units available are as follows:	These digits identify the center frequency in kilohertz.	These digits identify the maximum deviation for proportional or constant bandwidth channels. For proportional bandwidth channels, a % is added at the end of the five digits. For example, ±002.50% indicates a deviation of ±2.5%. For constant bandwidth channels, KHz is added at the end of the five digits.	These digits identify paint color and lettering. The colors and lettering are the same as listed for the Model 4130 in Table 2-2.
01 -- Six pole-pair filter, ±2.5% to ±20% deviations. 02 -- Four pole-pair filter, ±2.5% to ±30% deviations. 03 -- Two pole-pair filter, ±2.5% to ±45% deviations. 04 -- No filter (single-channel application only) ±2.5% to ±45% deviations. *11 -- Same as 01 except contains a built-in calibrator. *12 -- Same as 02 except contains a built-in calibrator. *13 -- Same as 03 except contains a built-in calibrator. *14 -- Same as 04 except contains a built-in calibrator.			

* See Appendix A for 4131-11, -12, -13, and -14 description.

Table 2-4. Part Number Identification, Model 4131 Reference Channel Selector

MODEL 4131 - XX-XXXX.XXX - XX

These digits identify the design sequence.	These digits identify the reference frequency in kilohertz.	These digits identify paint color and lettering. The colors and lettering are the same as listed for the Model 4130 Basic Unit in Table 2-2.
51 -- Contains an internal delay line. 52 -- Without delay line. * 58 -- Detranslating reference channel selector. 59 -- Same as -52 except intended for use with the EMR Model 4059 Group Frequency Detranslator.		

* See Appendix B for the 4131-58 description.

Table 2-4A. Part Number Identification,
Model 4131-61 Switchable Data Channel Selector

** MODEL 4131-61 - XXXX.XXX - XXX.XX - XXXXXX.X - X

These digits identify the highest of the six sub-carrier frequencies.	These digits identify the deviation in %. (Available deviations are 30% and 40%.)	These digits identify the highest of seven low-pass output filter cutoff frequencies.	This digit identifies the panel paint and lettering. Code is as follows: 1--Light Green 00048W* 2--Dark Green 00049W* 4--Gray 26492B* 9--Special * W or B following paint color number indicates white or black panel lettering.

** See Appendix C for the 4131-61 description.

Table 2-4B. Part Number Identification,
Model 4131-05 Switchable Deviation Data Channel Selector

**MODEL 4131-05 - XXXX.XXX - XXX.XX - ( ) - XXXXXX.X - X - X

These digits identify the center frequency in seven digit KHz.	These digits identify the maximum deviation in five digits expressed as a percent or KHz. Other deviations available in the unit are binarily related to this deviation.	This is the identifier for the deviation listed. A % is included for PBW, and KHz is included for CBW.	These digits identify the maximum cutoff frequency in seven digit Hz. Other cutoff frequencies available in the unit are binarily related to this frequency.	This digit identifies the low-pass output filter characteristic, CA, or CD.	This digit identifies the panel paint and lettering. Code is as follows: 1--Light Green, 00048W* 2--Dark Green, 00049W* 4--Gray, 26492B* 5--Light Beige, 00052B* 9--Special Paint * W or B following paint color number indicates white or black panel lettering.

** See Appendix D for the 4131-05 description.

Table 2-5. Part Number Identification, Model 4137 Output Filter

MODEL 4137 - XX - XXXXXX.X XX

These digits identify the filter design sequence described as follows:	These digits identify the data cutoff frequency in Hz. For example, 000003.0 indicates a cutoff frequency of 3 Hz.	These digits identify paint color and lettering. The colors and lettering are the same as listed for the Model 4130 in Table 2-2.
05 -- Switchable CA-CD response, 5-pole configuration with cutoff frequencies of 3 Hz through 450 KHz. Rolloff beyond cutoff is 30 Db/ octave. 06 -- Switchable CA-CD response, 7-pole configuration with cutoff frequencies of 3 Hz through 450 KHz. Rolloff beyond cutoff is 42 Db/ octave. 01, 02, and 03 -- Three-pole output filters available on special request. These units are not described in this manual. If a unit is purchased, appropriate information will be included.		

SECTION 3

INSTALLATION AND OPERATION

3.1 INSTALLATION

The EMR 4130 Subcarrier Discriminator is shipped completely assembled and ready for installation. All covers are installed and the plug-in modules are inserted into the basic unit. The unit should be inspected immediately on its arrival and notice given to EMR-Telemetry of any claim that the product does not conform with the terms of the order.

The 4130 is designed for installation in an EMR Model 4005 Rack Adapter. Up to seven units may be installed in a single rack adapter. The rack adapter is intended for installation in a standard 19-inch equipment rack or portable instrument case. (For information pertinent to the rack adapter, refer to the EMR Model 4005 Rack Adapter Instruction Manual.)

To install the 4130, align the unit on the T-rails on the bottom surface of the rack adapter interior and insert the unit. The connector on the rear of the 4130 mates with a connector in the rack adapter interior completing the electrical connections. Float-mounted connectors are used on both the 4130 and the rack adapter assuring proper electrical mating. After insertion into the rack adapter, push-to-lock knobs on the lower sections of the 4130 front panels are depressed securing the unit in the rack adapter. The electrical connections terminated at the 4130 rear connector and the rear connector pin layout are shown in Figure 3-1.

The 4130 is removed from the rack adapter by releasing the two push-to-lock knobs and pulling the unit straight out. Servicing of the 4130 is enabled by using the EMR Model 4601 Test Adapter. The test adapter is installed in the rack adapter in the location assigned to the 4130. A connector on the test adapter then plugs into the rear connector of the 4130. Test points on the test adapter provide access to each terminal of the 4130 rear connector.

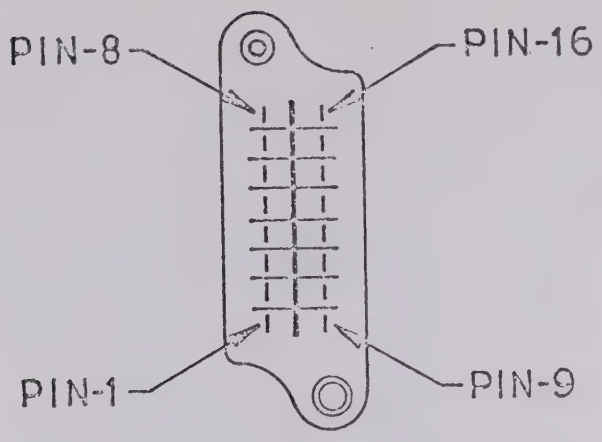
The plug-in modules of the 4130 are removable from the basic unit. The output filter is removed first by releasing the push-to-lock knob on the lower section of the output filter front panel and pulling straight out. The channel selector is then removed using the concealed sliding extractor under the channel selector chassis.

3.2 OPERATION

3.2.1 Front Panel Controls, Indicators and Test Jacks

The front panel components for the 4130 are illustrated in Figure 3-2 and described in Table 3-1. Figure 3-2 provides a front view of the 4130 with a typical channel selector and output filter installed in a data discriminator configuration. Other channel selectors and output filters available are illustrated in Sections 7 and 8 or in appendices of this manual. Also, Table 3-1 describes the function of the front panel components for the units shown. Additional components contained on other channel selectors and output filters are described in Sections 7 and 8.

Rear Connector Rear View



External Connections

PIN	FUNCTION
1	INPUT (TAPE-SPEED COMP.)
2	SIGNAL GROUND
3	
4	
5	
6	OUTPUT (DATA)
7	AC NEUTRAL
8	AC PHASE
*9	MPX OUT (REF.DISC.) (REF.OUT)
10	
11	
12	
*13	MULTIPLEX INPUT (REF. DISC.)
14	INPUT (SUBCARRIER)
15	SIGNAL GROUND
16	CHASSIS GROUND

* These pins are the remote calibration select lines for the Models 4131-11, -12, -13, and -14 Calibrating Channel Selectors. Pin 9 is the CAL 0 select (CF) and pin 13 is the CAL SENSE select (UBE).

Figure 3-1. EMR 4130 External Electrical Connections

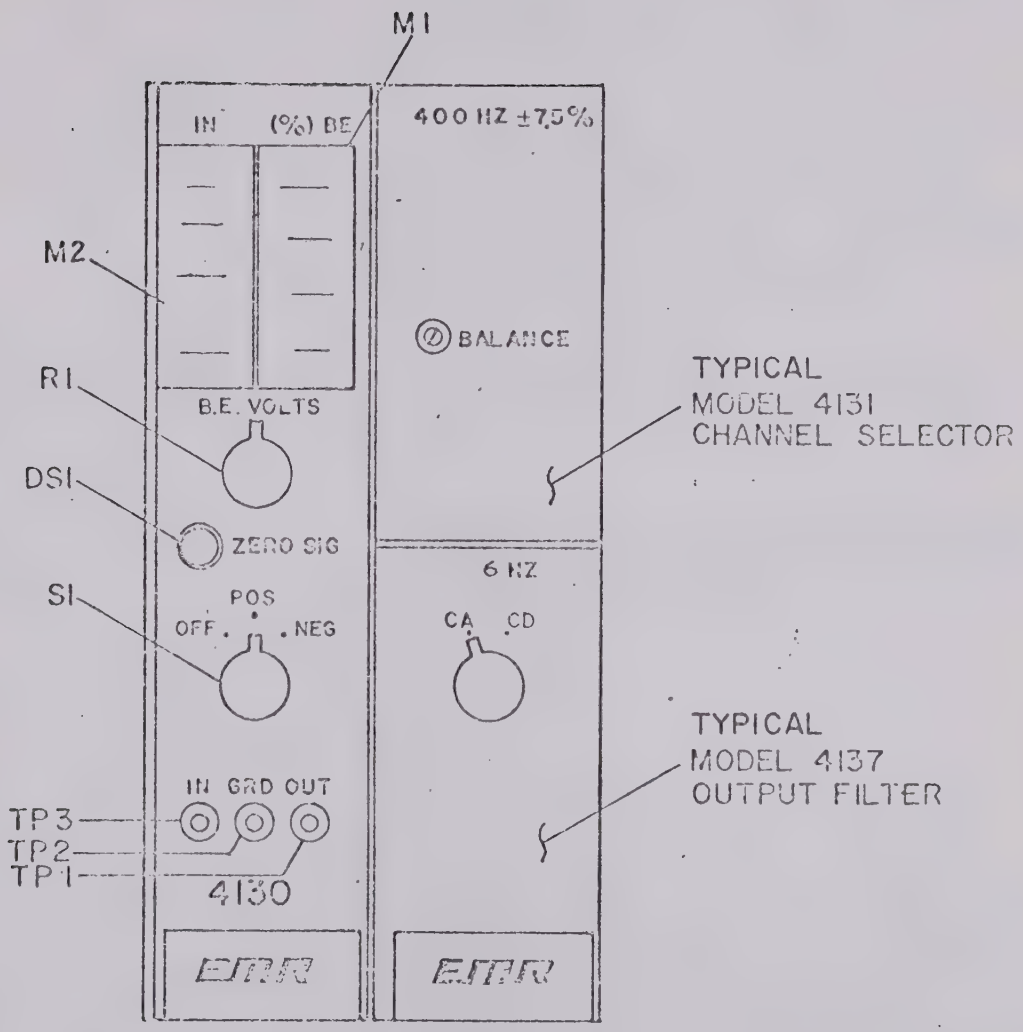


Figure 3-2. EMR 4130 Front Panel Controls and Indicators

Table 3-1. Function of Front Panel Controls and Indicators
(Ref. Figure 3-2)

DESIG.	NAME	FUNCTION
M1	(%) BE Meter	Displays the subcarrier channel deviation as a percentage from bandcenter (0) to either bandedge (U or L).
M2	IN Meter	Displays the level of the incoming subcarrier signal after the bandpass input filter. The lower black line is zero input, the second black line indicates an acceptable input, and the upper black line indicates 5 ±1 volt RMS input.
R1 (On the channel selector front panel)	BALANCE Potentiometer	Adjusts the data output to zero volt with a subcarrier channel center frequency input.
S1 (On the output filter front panel)	CA/CD	Selects the type of output filter response characteristics, constant amplitude (CA), or constant delay (CD).
TP1	OUT Test Jack	Data output.
TP2	GRD Test Jack	Ground.
TP3	IN Test Jack	Subcarrier signal at the BPIF output.
S1	OFF/POS/NEG Switch	Power OFF/ON and deviation sense switch. In POS position, the data output voltage increases when the subcarrier signal input frequency increases. In the NEG position, the data output voltage increases when the subcarrier signal input frequency decreases.
DS1	ZERO Signal Lamp	Illuminates when the subcarrier signal input amplitude is below the zero signal threshold. The zero signal threshold is adjustable between 2 millivolts RMS and 50 millivolts RMS.
R1	BE VOLTS	Adjusts the data output voltage. This voltage is adjustable from ±0.1 volt to ±10.5 volts for full bandedge-to-bandedge deviation.

When a 4130 is to be used as a reference discriminator, the Model 4131-50-Series Reference Channel Selector will be installed in the plug-in unit location.

3.2.2 Input Threshold Adjustment

The 4130 is adjusted at the factory for a minimum input threshold of 2 millivolts RMS; however, when required, this threshold level may be readjusted to any level between 2 and 50 millivolts RMS. To perform this adjustment, the zero signal detector must be adjusted. Perform the adjustment as follows:

a. Remove the cover from the 4130 and extend the unit from the mounting equipment. Also, remove the channel selector.

b. Using an external signal generator and RMS meter, apply a 10 KHz signal to the subcarrier input of the unit. The amplitude of this signal should be 2 millivolts RMS.

c. On the limiter card, install a jumper between TP1 and TP4.

d. Adjust limiter card potentiometer R51 so that the front panel IN meter needle is on the line between the red and white areas of the meter face.

e. Increase the level of the input signal to the desired minimum acceptable input level.

f. Adjust limiter card potentiometer R65 until the front panel ZERO SIG lamp just remains extinguished.

3.2.3 Zero-Signal Output Voltage Adjustment

The 4130 output voltage for a zero-signal input condition is adjusted at the factory to yield zero volts. However, this level may be readjusted to any value between the maximum upper and lower bandedge volts equivalent at the discriminator output. To perform a readjustment of the zero-signal output voltage, proceed as follows:

a. Remove the cover from the 4130 and extend the unit from the mounting equipment.

b. With input signal applied to discriminator, adjust BE VOLTS control for desired output voltage to correspond to the bandedges of the subcarrier channel.

c. Remove the input signal from the unit and observe that the front panel ZERO SIG lamp is illuminated.

CAUTION

In the next step do not attempt to adjust the zero-signal output voltage beyond the bandedge voltage set in step (b) above.

d. Monitor front panel OUT test jack TP1 with a DC voltmeter and adjust limiter card potentiometer R58 until the DC voltmeter indicates the desired level. This level may be set anywhere between the upper and lower bandedge volts equivalent.

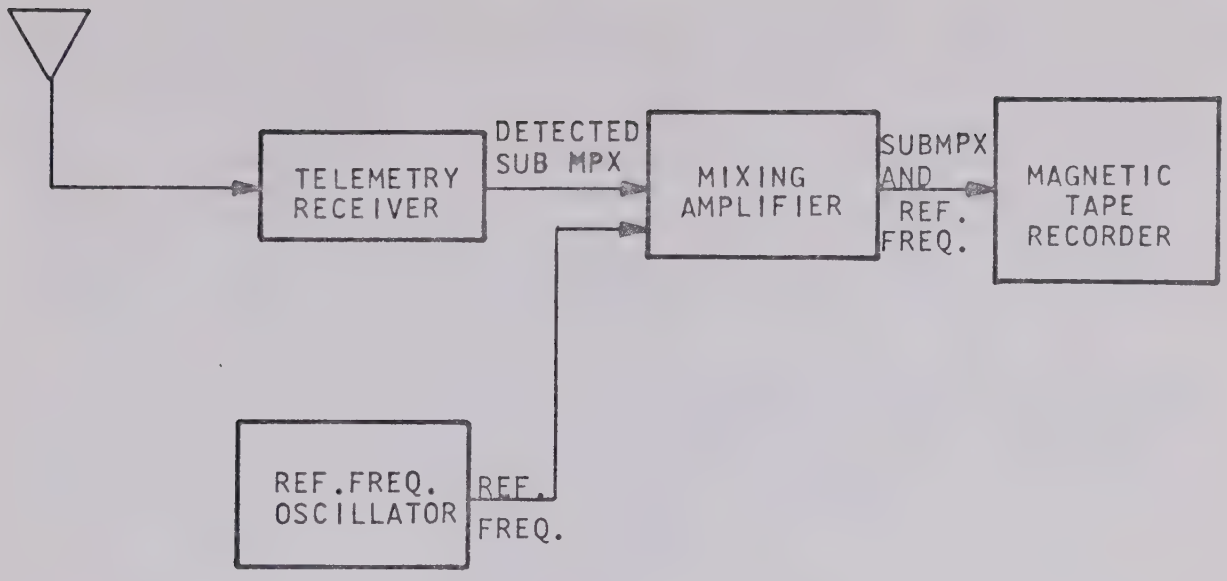
3.2.4 System Application

The EMR 4130 is part of the EMR 4000-Series modular equipment designed for use in ground FM telemetry systems. The 4130 when used as a data discriminator accepts single channel or multiplex information either in real time or recorded form and recovers the modulation component. Any size system can be set up with subcarrier frequencies in the range of 300 Hz to 2 MHz. The 4130 data output can be used as an input for recording, quick-look devices, and further data processing. The EMR 4130 can also be used as a reference discriminator in a playback data reduction system.

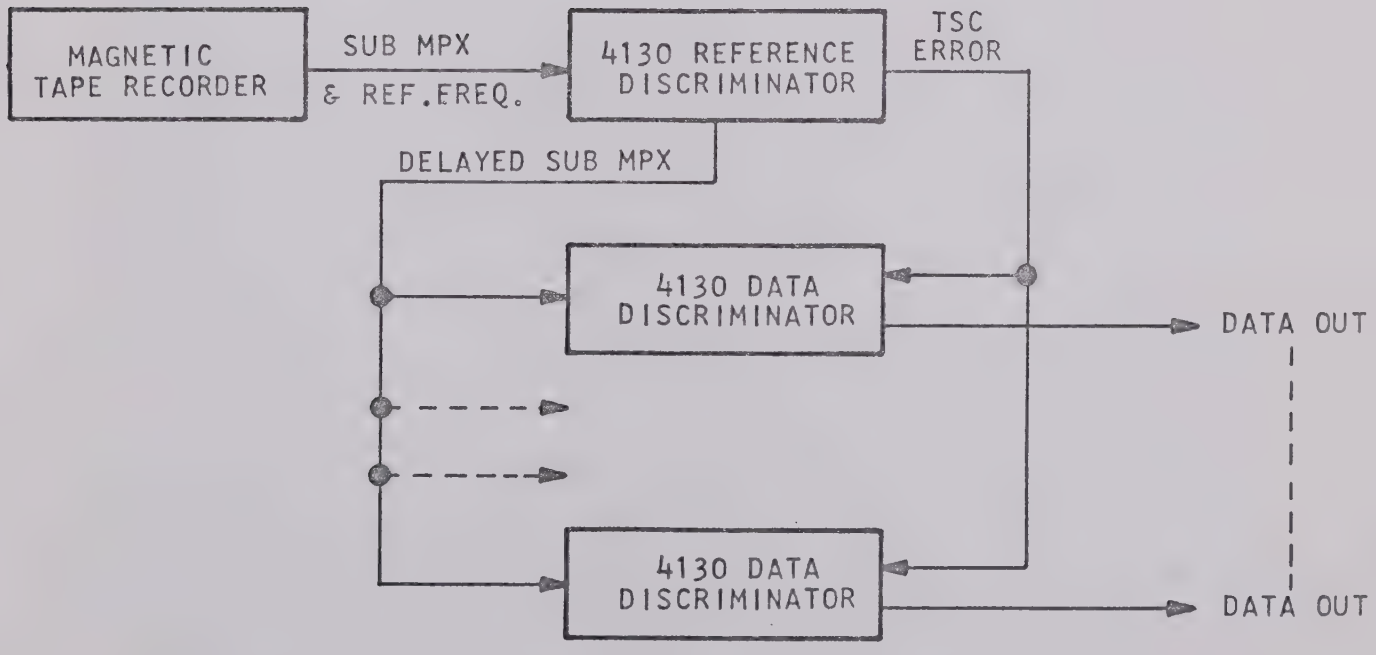
NOTE

When the 4130 data discriminator is used in a system not utilizing Tape-Speed Compensation (TSC), the TSC input terminal should be connected to signal ground. Since the 4130 is normally installed in a rack adapter, the ground connection is made at the rack adapter rear panel connectors. Refer to the rack adapter manual for wiring information.

Systems which reduce real-time data require only data discriminators operating from a subcarrier multiplex or single channel input. However, for playback systems in which the subcarrier multiplex has been prerecorded, use of a reference discriminator is recommended. Typical system configurations for the record and playback modes are shown in Figure 3-3. The record system is shown for reference only, since the 4130 is used only for real-time or playback data reduction.



TYPICAL RECORD SYSTEM



TYPICAL PLAYBACK SYSTEM

Figure 3-3. Typical Record/Playback System Block Diagram

In the playback system, the subcarrier multiplex (SUB MPX) including reference (REF) frequency is applied to the reference discriminator. This discriminator selects only the reference frequency from the subcarrier multiplex and detects any modulation contained on the reference frequency. If, during the record or playback of the magnetic tape, any tape-speed variations occurred, the reference frequency would be modulated as well as the subcarrier multiplex. Since the reference discriminator detects any modulation on the reference signal, the output of this unit is a tape-speed compensation (TSC) error signal. This output is then used to correct for erroneous modulation in the data channels.

Because delay is incurred in the reference discriminator, the subcarrier multiplex is delayed so that the subcarrier multiplex and TSC error signal will be applied to the data discriminators simultaneously. A built-in subcarrier multiplex delay is available in the reference discriminator which matches the total time delay in the reference discriminator. This delay is adjusted for the particular frequency of the reference discriminator.

Another type system is also available using EMR 4130 components, that is a 12-channel detranslating FM system. This system is fully described in the EMR 4131-58 Appendix which will be included in this manual when a 4131-58 is purchased.

SECTION 4

THEORY OF OPERATION

4.1 GENERAL

The theory of operation as presented in this section describes in detail the circuits of the Model 4130 Basic Unit with only general information regarding the plug-in Model 4131 Channel Selectors and Model 4137 Output Filters. Detailed circuit descriptions for the channel selectors and output filters are contained in Sections 7 and 8, respectively. Included in this theory discussion are descriptions of the limiter card circuits, output amplifier card circuits, and power supply/regulator circuits. An overall block diagram of the 4130 is shown in Figure 4-1.

4.2 MODEL 4134 LIMITER CARD CIRCUITS

The limiter card contains an input amplifier, a limiter circuit and −5 volt regulator, a meter amplifier and meter rectifier/filter, a zero-signal detector, and a −15 volt reference regulator. These circuits are shown in the detailed block diagram and are described in the following paragraphs.

4.2.1 Input Amplifier (Ref. Figure 4-1)

The subcarrier multiplex or single channel input is routed from the 4130 rear connector to the input amplifier circuit. This circuit is a conventional amplifier which provides proper terminating impedance for the signal input and increases the drive capability of the input signal for use in the 4130 circuits. The output of this circuit is applied through chassis connectors J5 and J2 to the plug-in channel selector. Typically, this output would be coupled to a bandpass input filter (BPIF) which selects a particular subcarrier channel from a multiplex of channels. For single channel applications, a BPIF is not included.

4.2.2 Limiter Circuit (Ref. Figures 4-1 and 4-2)

The limiter circuit operates from a signal input from the BPIF (in the channel selector) to provide a constant-amplitude square-wave output representative of the selected subcarrier signal input. The zero crossings of the signal input are maintained, thus maintaining the modulation component of the subcarrier signal.

Included in the limiter circuit is an amplifier stage, two diode limiting stages, and a Schmitt trigger/level translator stage. The amplifier is a high-gain stage with diode limiters included across the input transistor pair. These diodes limit the voltage swing to approximately 1.4 volts peak-to-peak internal to the amplifier. A second diode limiter stage provides additional limiting at the amplifier output. The voltage swing at the amplifier output is limited to approximately ±1.4 volts.

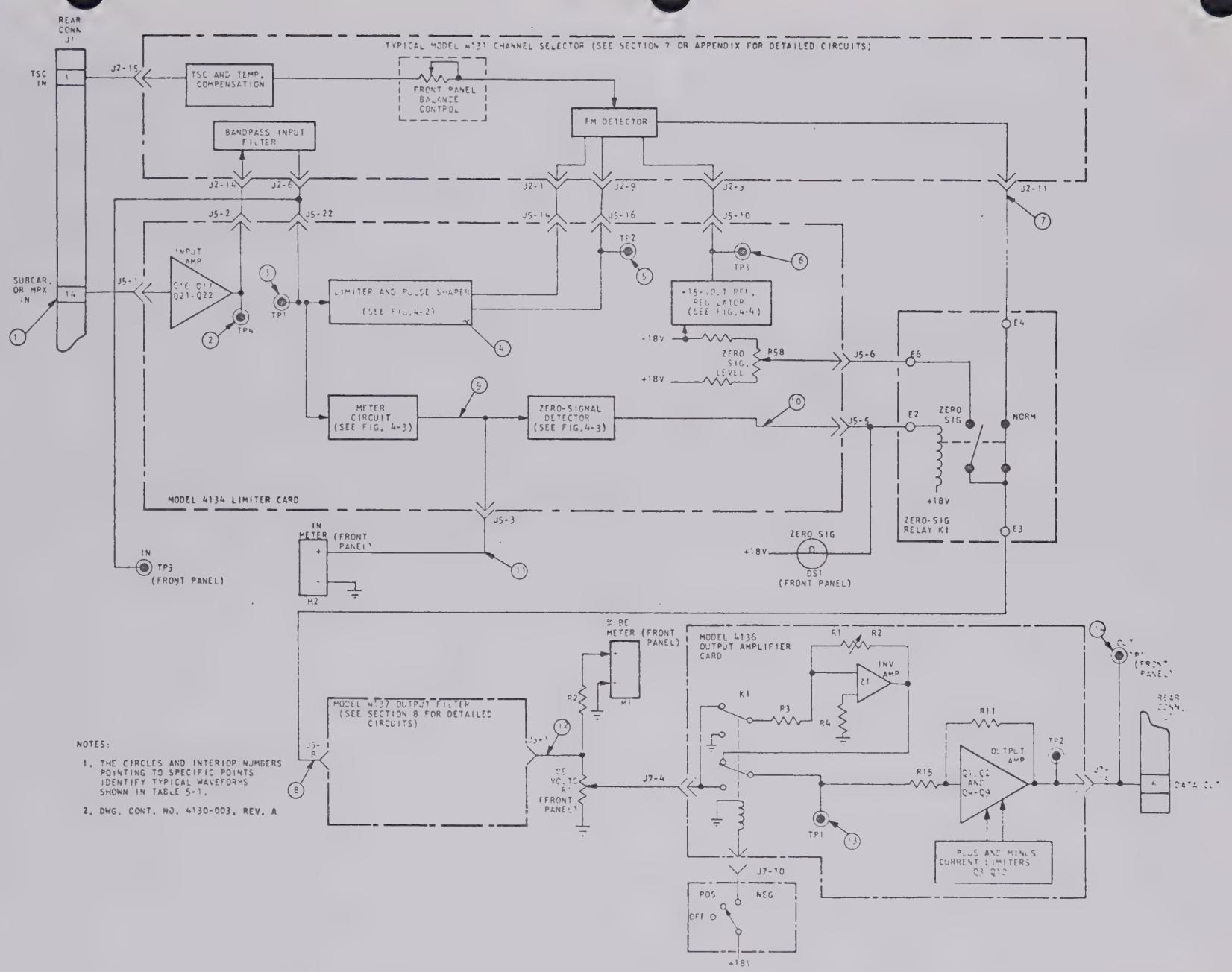


Figure 4-1. EMR 4130 Subcarrier Discriminator Detailed Block Diagram

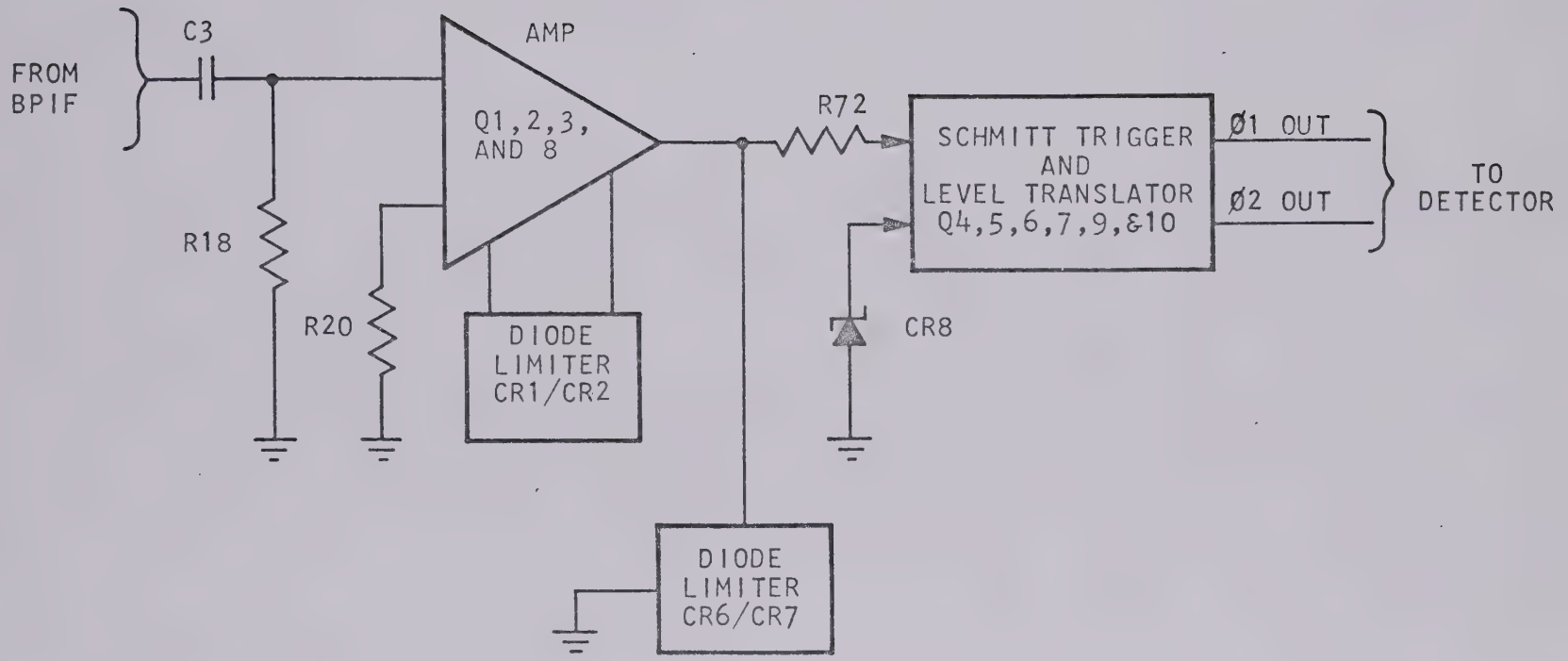


Figure 4-2. Limiter Circuit Simplified Schematic Diagram

The Schmitt trigger/level translator is a high-gain switching network which provides pulse shaping and additional limiting of the subcarrier signal. Signal levels of the complementary outputs (Ø1 and Ø2) are translated to the levels required for proper operation of the FM detector circuit. The level of the Ø1 and Ø2 outputs is approximately 1.5 volts peak-to-peak centered around a −15 volt reference.

4.2.3 Meter Circuit (Ref. Figures 4-1 and 4-3)

The meter circuit operates from the subcarrier signal output of the bandpass input filter (BPIF) to provide a level indication of the subcarrier signal. The meter circuit in addition to driving the front panel IN meter also supplies the signal input to the zero-signal detector circuit. Included in the meter circuit is a meter amplifier, a positive peak detector, a DC amplifier, and a meter nonlinearizing/protect network.

The subcarrier input is first amplified by the meter amplifier and then AC coupled to the positive peak detector. Potentiometer R51 in the meter amplifier adjusts the amplifier gain such that when a 2 millivolt input is recognized, the IN meter will indicate the 2 millivolt level.

The positive peak detector rectifies the signal providing only the positive portion of the subcarrier signal to the DC amplifier. On the negative half cycle, diode CR18 is forward biased and the negative peaks are shunted to ground. The DC amplifier converts the positive peaks of the signal into an average DC level which is used to drive the IN meter. However, since the IN meter is to display low-level signals as well as high-level signals (up to 5 volts), the meter scale is nonlinear. Therefore, the source voltage for the meter must also be nonlinear. As the DC level output from the DC amplifier increases, diode CR12 becomes forward biased shunting current around the meter. Further voltage increases result in additional current shunting.

A feedback loop around the DC amplifier is also used to provide a certain amount of nonlinearizing of the signal output to the meter. Diode CR9 becomes forward biased when the DC amplifier output increases to a certain level. When forward biased, the feedback is increased thereby reducing the gain of the amplifier.

Diode CR11 is a meter protect component which shunts current to ground around the meter when the signal level decreases significantly. With a significant decrease in signal level (or a loss of signal), capacitors in the meter circuit discharge and would (without CR11) drive the meter indicator in a negative direction resulting in possible damage to the meter.

4.2.4 Zero-Signal Detector (Ref. Figures 4-1 and 4-3)

The zero-signal detector operates from the meter amplifier output to detect an unacceptable input-signal level. When an unacceptable input level is detected, this circuit illuminates the front panel ZERO SIG lamp and energizes zero-signal relay K1. In this condition, the FM detector output to the output filter is interrupted and the voltage level established at zero-signal adjust potentiometer R58 is coupled to the output filter.

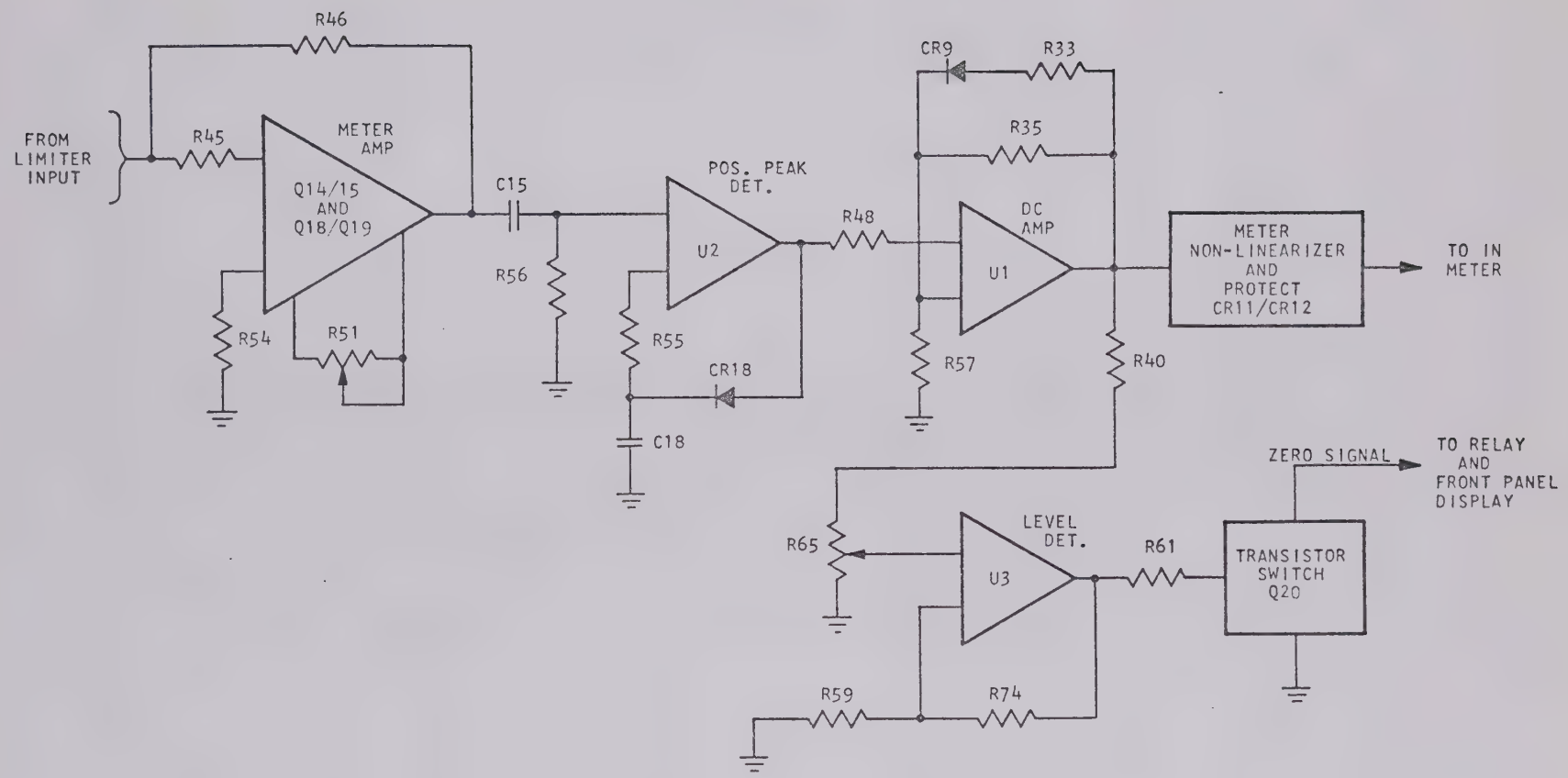


Figure 4-3. Meter Circuit and Zero-Signal Detector Simplified Schematic Diagram

Included in the zero-signal detector circuit is a level detector stage (U3) and a transistor switch (Q20). The minimum acceptable level is adjustable between 2 and 50 millivolts. The minimum level is adjusted by potentiometer R65 at the U3 input. As the signal input level (derived from the meter circuit) drops to or below the selected level, U3 detects the condition and closes transistor switch Q20. When closed, Q20 supplies a ground potential on the ZERO SIGNAL output line. This line is connected to both the front panel ZERO SIG indicator DS1 and to the zero signal relay K1. The other side of DS1 and K1 is connected to +18 volts. Therefore, when Q20 is closed, the circuit is completed from ground through both components to the +18-volt source illuminating the lamp and energizing the relay.

4.2.5 −15-Volt Reference Regulator (Ref. Figures 4-1 and 4-4)

The −15-volt reference regulator is a standard series regulator which provides an extremely accurate −15-volt reference output to the detector contained in the channel selector. A differential amplifier Q11/Q12 compares a sample of the output potential with a voltage reference (CR4) to detect any change in output voltage. If any output voltage change occurs, Q12 supplies an out-of-phase signal to series regulator transistor Q13 correcting the voltage change. Potentiometer R34 establishes the magnitude of the regulated DC voltage output.

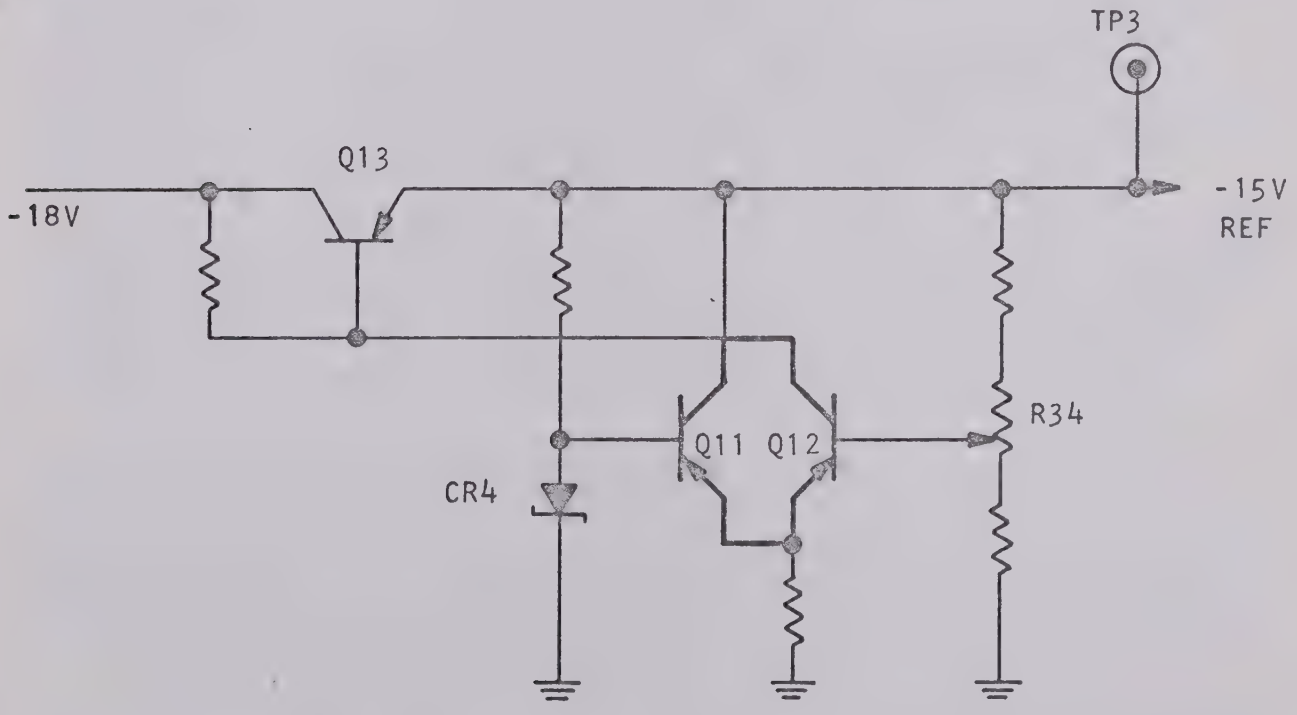


Figure 4-4. −15-Volt Reference Regulator Simplified Schematic Diagram

4.3 MODEL 4136 OUTPUT AMPLIFIER CARD CIRCUITS

The output amplifier card contains a deviation sensitivity selection network and an output amplifier including current limiter stages. These circuits are shown in the detailed block diagram and are described in the following paragraphs.

4.3.1 Deviation Sensitivity Selection Network (Ref. Figure 4-1)

This network provides a means of selecting either positive or negative deviation sensitivity as established by front panel OFF/POS/NEG selection switches. Included in this network is a unity gain inverting amplifier (Z1), relay K1, and a front panel selection switch.

The voltage selected at the front panel BE VOLTS control is coupled to relay K1. Depending upon the deviation sensitivity setting, the selected voltage is either coupled through relay K1 (NEG setting) to the output amplifier or is inverted by amplifier (Z1) and then coupled through relay K1 (POS setting).

4.3.2 Output Amplifier and Current Limiters

The output amplifier is a conventional power amplifier which operates from the selected voltage at relay K1 to provide a high-current, low-impedance data output signal. This circuit is connected as an operational amplifier with a fixed gain of approximately 14. The output voltage is determined by the magnitude of the voltage selected at the front panel BE VOLTS control; however, the maximum output voltage is approximately 21 volts peak-to-peak (±10.5 volts for bandedge-to-bandedge deviation).

Current for operation of the amplifier power output stage is supplied by the plus and minus current limiters. Maximum current available is ±100 milliamperes for data frequencies up to 450 KHz. The current limiting occurs at approximately 130 milliamperes. A short circuit at the output will not permanently damage any components of the output amplifier.

4.4 MODEL 4135 POWER SUPPLY CARD CIRCUITS (REF. FIGURE 5-5)

The power supply card circuits and chassis-mounted transformer and series regulator transistors operate from a primary AC power input to generate all DC voltages for operation of the 4130. The primary AC power input requirements are outlined in Section 2, paragraph 2.2, step (t).

Included on the power supply card is a diode rectifier and two regulator circuits. The regulators are conventional series regulators generating +18 volts and −18 volts. Regulation is performed by comparing a sample of the output with a voltage reference established by a zener diode. Any voltage change is amplified by a differential amplifier and supplied to a Darlington-connected series regulator. A constant current source in each regulator supplies quiescent current for the differential amplifiers.

SECTION 5

MAINTENANCE

5.1 GENERAL

This section contains information to aid in troubleshooting and maintaining the 4130 Subcarrier Discriminator. The information is generalized to cover any 4130 configuration. Any special maintenance to be performed for various plug-in channel selectors and output filters is contained in Sections 7 and 8.

Also included in this section is a complete complement of assembly, schematic and wiring diagrams for the Model 4130 Basic Unit. These diagrams are contained in Figures 5-1 through 5-8. Diagrams illustrating the plug-in Model 4131 Channel Selectors and Model 4137 Output Filters are contained in Section 7 and 8.

5.2 TROUBLESHOOTING

The general method for troubleshooting the 4130 is as follows:

a. Perform an inspection (paragraph 5.2.1).

b. Check power supply card for proper operation (paragraph 5.2.2).

c. Check discriminator waveforms to isolate the malfunction to a functional circuit (paragraph 5.2.3).

d. Check transistor voltage measurements in malfunctioning circuit (paragraph 5.2.4).

e. When defective component is isolated, refer to paragraph 5.3, Repairs, before replacing any components.

5.2.1 Inspection

The discriminator should be subjected to a regular inspection program. The inspection should be performed periodically as a means of preventive maintenance or, if a malfunction occurs, to aid in isolating the trouble. An inspection should include the following:

a. Inspect front and rear panel components for signs of damage or looseness.

b. Remove the covers and inspect the internal wiring of the basic unit and plug-in units for loose or broken connections.

c. Inspect plug-in cards in the basic unit, channel selector and output filter cards for mechanical damage or component discoloration.

NOTE

Do not replace any component before reading the instructions contained in paragraph 5.3, Repairs.

5.2.2 Power Supply Check (Ref. Figures 5-4 and 5-5)

Before troubleshooting any 4130 circuits, check the power supply/regulator for proper outputs. The following guide should be used to check the power supply.

a. Remove the cover from the basic unit and extend the unit from the rack adapter using a test adapter.

b. Position front panel OFF/POS/NEG switch to POS or NEG and, using a DC voltmeter, monitor power supply card test jacks TP2 and TP3 for +18 and −18 volts ±10 millivolts, respectively.

c. If voltages are in error, refer to paragraph 5.4, Adjustments, or troubleshoot power supply regulator circuits using the schematic diagram and transistor voltage measurements contained in Table 5-4.

5.2.3 Circuit Waveforms

The circuit waveforms are designed to isolate a malfunction to a functional circuit in the discriminator. These waveforms are shown in Table 5-1. Figure 4-1, detailed block diagram, should be used in conjunction with the discriminator waveform table since this diagram illustrates all functional circuits and prime signal flow in the unit.

The waveforms shown in Table 5-1 are typical for any discriminator configuration, however, when applying an input signal, the signal parameters must correspond to the parameters established by the plug-in units. If, when checking the waveforms, the malfunction is isolated to circuits of the channel selector or output filter, refer to Sections 7 or 8 for maintenance information.

To check the waveforms, the following preliminary steps shall be taken:

a. Remove the Model 4130 Basic Unit cover and extend the unit from the rack adapter using a test adapter.

b. Obtain a subcarrier oscillator with operating parameters of the channel selector installed in the unit.

c. Supply a ground level potential to the tape-speed compensation (TSC) input of the discriminator.

d. Apply a subcarrier signal of 2 volts peak-to-peak at the center frequency of the subcarrier channel.

5.2.4 Transistor Voltage Measurements

Transistor voltage measurements for the plug-in cards in the Model 4130 Basic Unit are contained in Tables 5-2 through 5-4. For transistor voltage measurements in the channel selector and output filter, refer to Sections 7 and 8. It should be noted that the voltages in Tables 5-2 through 5-4 are typical for circuits during normal operation and that the actual voltages may differ slightly from those provided. However, in a malfunctioning circuit, the readings will differ significantly from the typical voltages. Access to the transistors on the plug-in cards is obtained by removing the cover from the unit and extending the unit from the rack adapter using a test adapter. When a malfunctioning component is located, refer to paragraph 5.3, Repairs, before replacing the component.

5.3 REPAIRS

The circuits of the Model 4130 Basic Unit may generally be repaired without affecting the overall unit performance or degrading the unit specifications. (Repairs in the Model 4131 Channel Selectors and Model 4137 Output Filters are described in Sections 7 and 8, respectively.) However, the limiter circuit contains a matched transistor pair in the limiter circuit input amplifier. These transistors are identified as Q8A and B. If either of these transistors malfunction, both must be replaced with another matched pair.

All defective components are replaced by referring to parts descriptions in the appropriate parts list table in Section 6. After replacing defective components, certain circuits require readjustment. To ascertain whether readjustment is required, refer to paragraph 5.4, Adjustments.

5.4 ADJUSTMENTS

Adjustments in the Model 4130 Basic Unit circuits may be necessary after component replacement or after long periods of operation. (Adjustments in the Model 4131 Channel Selectors and Model 4137 Output Filters are contained in Sections 7 and 8.) Adjustments in the basic unit are as follows:

a. Meter Amplifier

b. Zero Signal Detector

c. Zero Signal Output Voltage

d. Limiter Circuit Symmetry

e. -15-Volt Reference Regulator

f. -18-Volt and +18-Volt Regulators

g. Output Amplifier

NOTE

When a circuit component is replaced, always check the circuit for proper adjustment as follows:

a. LIMITER and PULSE SHAPER -- Perform Limiter Circuit Symmetry adjustment.

b. METER CIRCUIT -- Perform the Meter Amplifier and Zero Signal Detector adjustments.

c. -15-VOLT REFERENCE REGULATOR CIRCUIT -- Perform the -15-Volt Reference Regulator adjustment.

d. OUTPUT AMPLIFIER CIRCUIT -- Perform the Output Amplifier adjustment.

Adjustment procedures for (a), (b), and (c) above are contained in Section 3, paragraph 3.2. Adjustment procedures for (d) through (g) are contained in the following paragraphs.

5.4.1 Limiter Circuit Symmetry Adjustment (Ref. Figures 4-1, 5-2, and 5-3)

a. Remove the cover from the basic unit and extend the unit from the rack adapter using a test adapter.

b. Remove the plug-in channel selector from the basic unit.

c. Using an external signal generator, apply a 10 KHz, 2 millivolt RMS, at the subcarrier input.

d. Connect a jumper between limiter card test jacks TP1 and TP4.

e. Using an oscilloscope, monitor limiter card test jack TP2.

f. Adjust the oscilloscope to display one complete cycle of the square wave at TP2. Level should be approximately 7 volts peak-to-peak.

g. Adjust limiter card potentiometer R2 for a symmetrical square wave at TP2.

h. Increase the frequency of the signal input to 2.9 MHz and increase the amplitude to 5 millivolts RMS.

i. Check the symmetry of the square wave at TP2. Slight readjustment at R2 may be necessary.

5.4.2 -15-Volt Reference Regulator Adjustment (Ref. Figures 5-2 and 5-3)

a. Remove the cover from the basic unit and extend the unit from the rack adapter using a test adapter.

b. Remove the plug-in channel selector from the basic unit.

c. Position front panel OFF/POS/NEG switch to POS or NEG.

d. Connect a 500Ω load between limiter card test jack TP3 and front panel GRD test jack.

e. Using a DC voltmeter, monitor limiter card test jack TP3 and adjust limiter card potentiometer R34 for a -15-volt indication. This level must be within ±10 millivolts of the -15 volts.

5.4.3 -18-Volt and +18-Volt Regulators Adjustment (Ref. Figures 5-4 and 5-5)

a. Remove the cover from the basic unit and extend the unit from the rack adapter using a test adapter.

b. Position the front panel OFF/POS/NEG switch to POS or NEG.

c. Using a DC voltmeter, monitor power supply card test jack TP2 and adjust power supply card potentiometer R5 for a +18-volt indication. This level must be within ±10 millivolts of the +18 volts.

d. Using a DC voltmeter, monitor power supply card test jack TP3 and adjust power supply card potentiometer R11 for −18-volt indication. This level must be within ±10 millivolts of the −18 volts.

5.4.4 Output Amplifier Adjustment (Ref. Figures 5-6 and 5-7)

a. Remove the output filter from the 4130 Basic Unit.

b. Using a jumper, short the output amplifier card connector pin 4 to ground.

c. Position the front panel OFF/POS/NEG switch to NEG.

d. Monitor the data output (front panel OUT test jack TP1) with a DC voltmeter and adjust output amplifier card potentiometer R16 for a 0-volt output indication.

e. Position the front panel OFF/POS/NEG switch to POS.

f. Adjust output amplifier card potentiometer R5 for a 0-volt (±2 millivolts) output indication.

g. Remove the jumper installed in step (b) and install the channel selector and output filter in the basic unit.

h. Using an external signal generator, apply a bandedge frequency input to the subcarrier input of the discriminator.

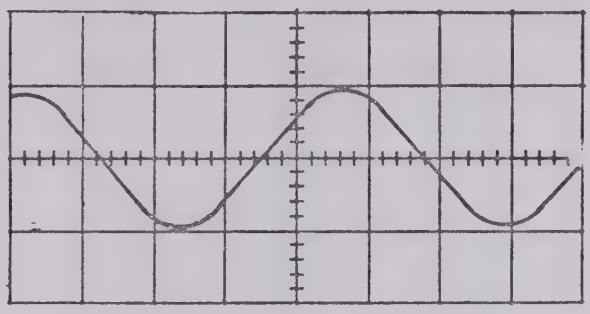
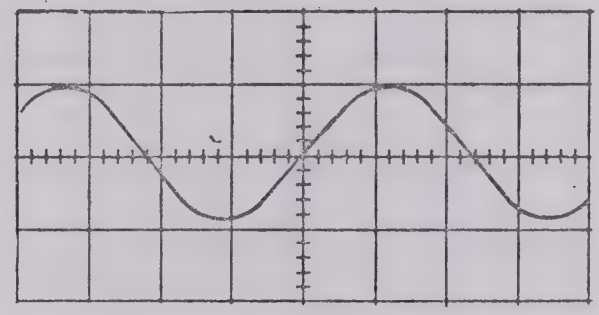
i. Position the front panel OFF/POS/NEG switch to NEG.

j. Monitor the data output terminal with a DC voltmeter and adjust the front panel BE VOLTS control for a 10-volt indication.

k. Position the front panel OFF/POS/NEG switch to POS.

l. Adjust output amplifier card potentiometer R2 for the same output voltage as step (j) (less than 0.1% change).

Table 5-1. EMR 4130 Subcarrier Discriminator, Circuit Waveforms (Ref. Fig. 4-1)

CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Center frequency Subcarrier input at rear connector J1 pin 14	2-volts peak-to-peak	(1) 	1V/Cm	---
Input amp. output on limiter card test jack TP4	2-volts peak-to-peak	(2) 	1V/Cm	---

NOTE
If waveform 3 is not as shown below, refer to Section 7 for BPIF maintenance.

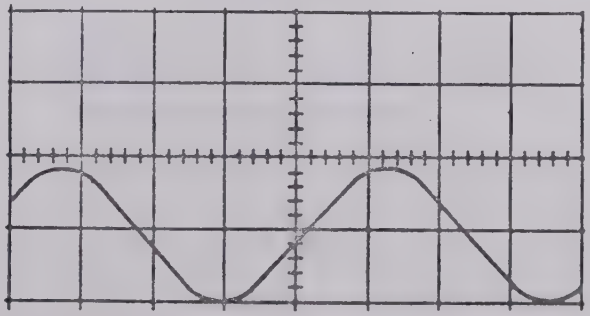
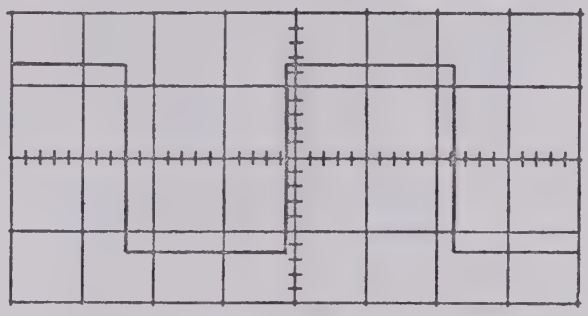
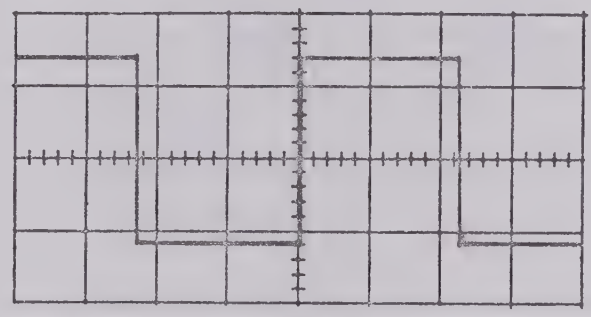
Bandpass input filter (BPIF) output on limiter card test jack TP1.	2-volts peak-to-peak	(3) 	1V/Cm	---

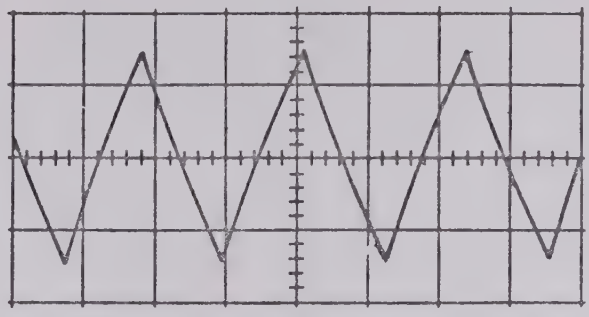
Table 5-1 (Cont'd). EMR 4130 Subcarrier Discriminator, Circuit Waveforms (Ref. Figure 4-1)

CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Limiter circuit at Q3 collector (Ref. Figs. 5-2, 5-3)	2-volts peak-to-peak	(4) 	.5V/Cm	----
Limiter output at limiter card test jack TP2	2-volts peak-to-peak	(5) 	.5V/Cm (Use AC coupling to oscs. because of large negative offset.	----
-15volt reference regulator output at limiter card test jack TP3	2-volts peak-to-peak	(6) Measure for -15 volts ±10 millivolts	---	---

NOTE

If waveform 7 is not as shown below, refer to Section 7 for detector maintenance.

Table 5-1 (Cont'd). EMR 4130 Subcarrier Discriminator, Circuit Waveforms (Ref. Figure 4-1)

CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Detector output at chassis connector J2 pin 11		(7) 	1V/Cm	---

NOTE

If waveform 8 is not as shown below, continue with waveforms 9 and 10. However, if waveform 8 is correct, skip waveforms 9, 10, and 11. Waveform 11 is provided only to check input to front panel IN meter M1.

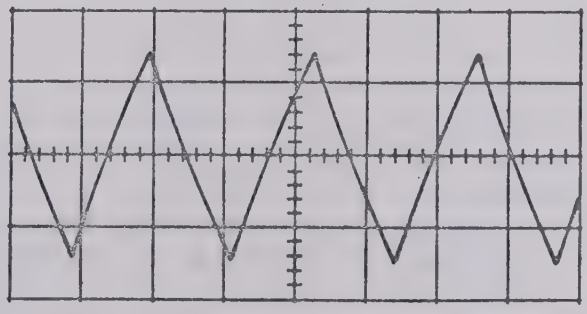
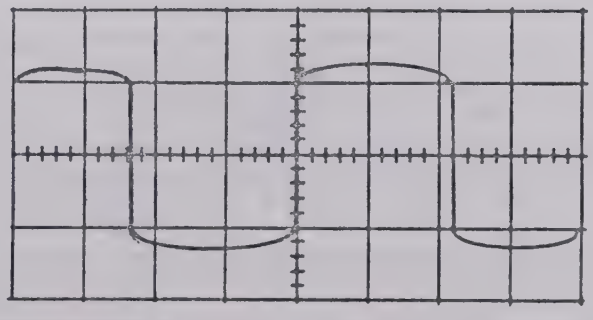
Detector output to lowpass output filter at chassis connector J3 pin 8	2-volts peak-to-peak	(8) 	1V/Cm	---
Meter amp. output at (-) side of limiter card capacitor C15	2-volts peak-to-peak	(9) 	1V/Cm	---

Table 5-1 (Cont'd). EMR 4130 Subcarrier Discriminator, Circuit Waveforms (Ref. Figure 4-1)

CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Zero-signal detector to relay and front panel ZERO SIG lamp at chassis connector J5 pin 5.	2-volts peak-to-peak	(10) Measure DC voltage. +18 volts for proper operation and +0.0 volts for improper operation.	---	---
Meter rectifier/ front panel meter at chassis connector J5 pin 3.		(11) Measure for +0.050 volts DC.	0.05/Cm	---

NOTE

For the remaining waveforms, modulate the subcarrier signal input to the unit using a data signal of approximately 1/10 the cutoff frequency of the lowpass filter installed in the unit. The modulating data signal should deviate the subcarrier signal input from bandedge-to-bandedge. If waveform 12 is not as shown below, refer to Section 8 for output filter maintenance.

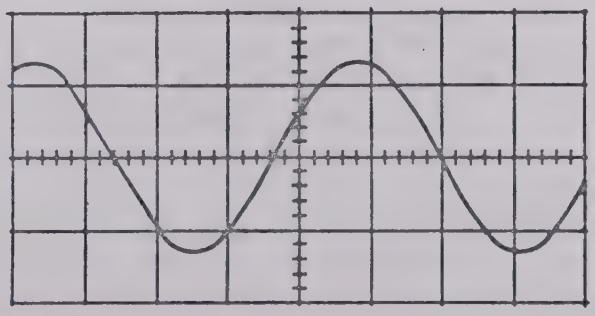
Lowpass output filter (LPOF) output at chassis connector J3 pin 1.	2-volts peak-to-peak with data modulation.	(12) 	.5V/Cm	---

Table 5-1 (Cont'd). EMR 4130 Subcarrier Discriminator, Circuit Waveforms (Ref. Figure 4-1)

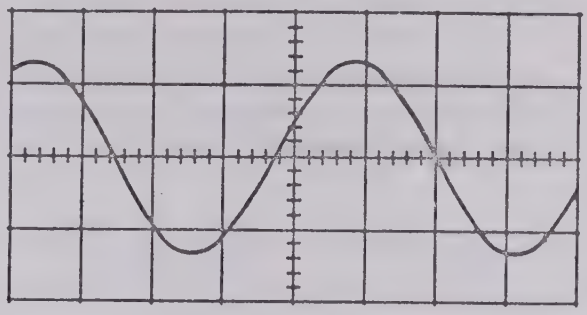
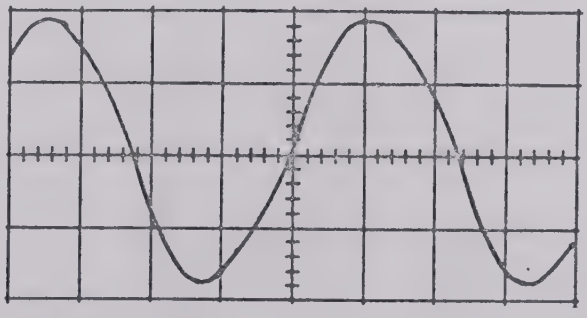
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Deviation sensitivity selection components output at output amp card test jack TP1.	2-volts peak-to peak with data modulation.	(13)  (Switch front panel OFF/POS/NEG switch S1 to POS and NEG and observe that waveform is as shown. Also adjust front panel B. E. VOLTS control to obtain amplitude as shown.)	.5V/Cm	---
Data output at front panel OUT test jack TP1	2-volts peak-to peak with data modulation.	(14)  (Adjust front panel B. E. VOLTS control to ascertain that output amplitude is approximately 20 volts peak-to-peak.	5V/Cm	---

Table 5-2. Limiter Card Transistor Voltages

CAUTION

Ground plane is located on certain areas of the component side of the Limiter Card. Care should be exercised when measuring terminal voltages of the components mounted in these areas. Damage to components may result if accidental shorting occurs.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+9.4	+10.0	+17.8
Q2	+9.4	+9.4	GRD
Q3	+9.4	+8.7	+0.6
Q4	+0.5	+0.6	-5.0
Q5	+0.5	-0.2	-4.3
Q6	-4.9	-5.0	+0.6
Q7	-4.9	-4.3	-0.2
Q8A	-0.6	0.0	+18.0
Q8B	-0.6	0.0	+10.0
Q9	-4.3	-5.0	-14.3
Q10	-4.3	-4.3	-15.6
Q11	-5.7	-6.4	-15.0
Q12	-5.7	-15.7	-15.7
Q13	-15.0	-15.7	-18.0
Q14	+9.4	+8.7	GRD
Q15	+0.6	0.0	-9.8
Q16	+5.3	+5.9	+18.0
Q17	+6.1	+4.8	-0.2
Q18	-0.6	0.0	+18.0
Q19	-0.7	0.0	+8.7
Q20	GRD	+0.7	0.0
Q21	-14.6	-13.9	-0.2
Q22	-14.2	-13.6	+5.3

NOTES:

1. Voltages taken with subcarrier and TSC inputs grounded.
2. Use DVM for voltage measurements.

Table 5-3. Output Amplifier Card Transistor Voltages

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+14.22	+14.90	+18.0
Q2	+14.75	+14.22	+1.30
Q3	+29.0	+28.4	+29
Q4	+0.72	+1.30	+29
Q5	+0.18	+0.72	+29
Q6A	-0.57	0.0	+18.0
Q6B	-0.57	0.0	+14.90
Q7	-0.73	-1.28	-29.4
Q8	-0.20	-0.78	-29.4
Q9	-14.86	-14.22	-1.30
Q10	-29.4	-28.7	-29.4

NOTES:

1. Same conditions as Table 5-2.
2. POS sense selected.
3. Zero-signal clamp voltage at 0-volt.

Table 5-4. Power Supply Card Transistor Voltages

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+31.2	+30.7	+19.2
Q2	+18.6	+19.2	+31.9
Q3	+8.6	+9.2	+18.0
Q4	+8.6	+9.2	+19.2
Q5	+0.6	GRD	-18.0
Q6	+0.6	-0.01	-19.0
Q7	-31.4	-30.8	-19.0
Q8	-18.6	-19.0	-32.2
CHASSIS COMPONENTS			
Q1	-18.0	-18.6	-32.2
Q2	+18.0	+18.6	+31.9

NOTES:

1. Voltages taken with power supply unloaded.
2. Use DVM for voltage measurements.

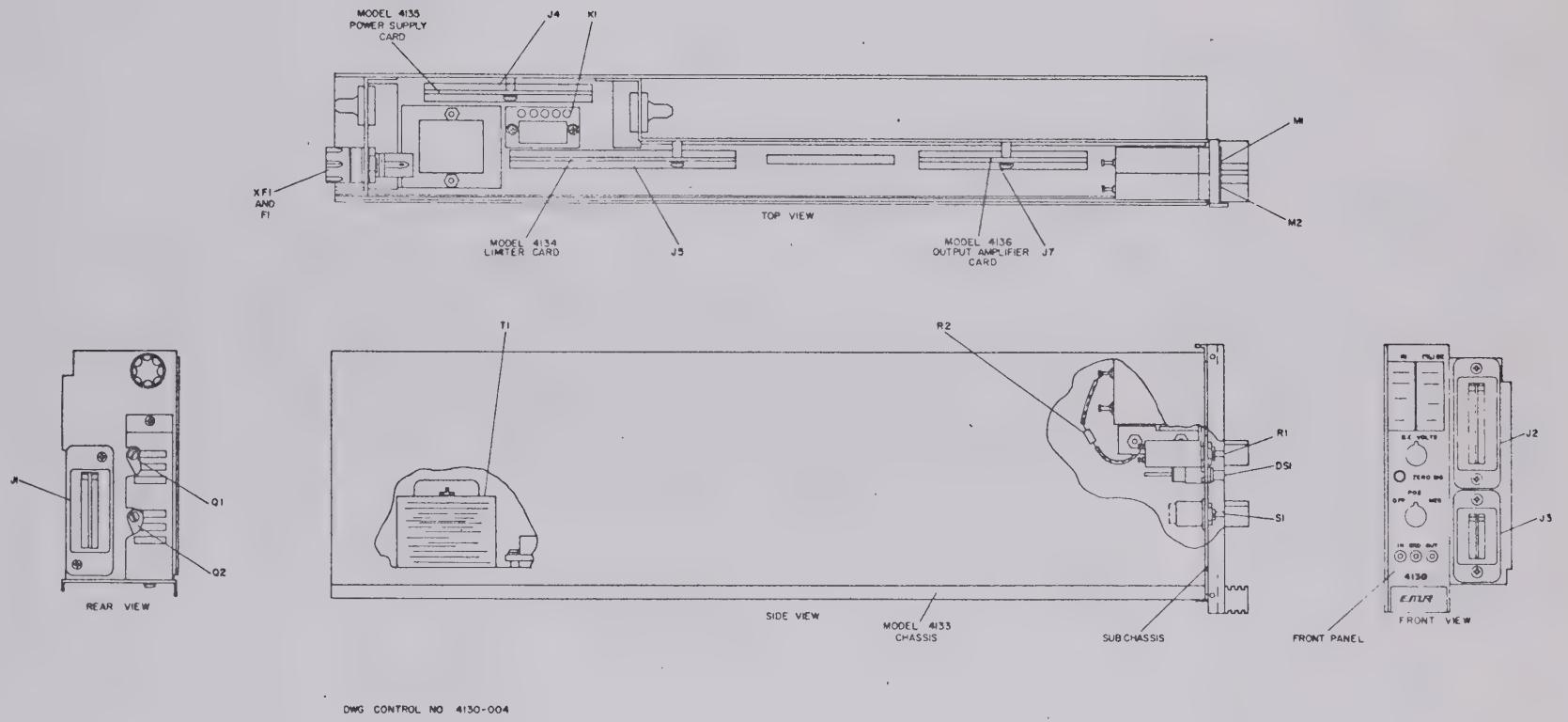
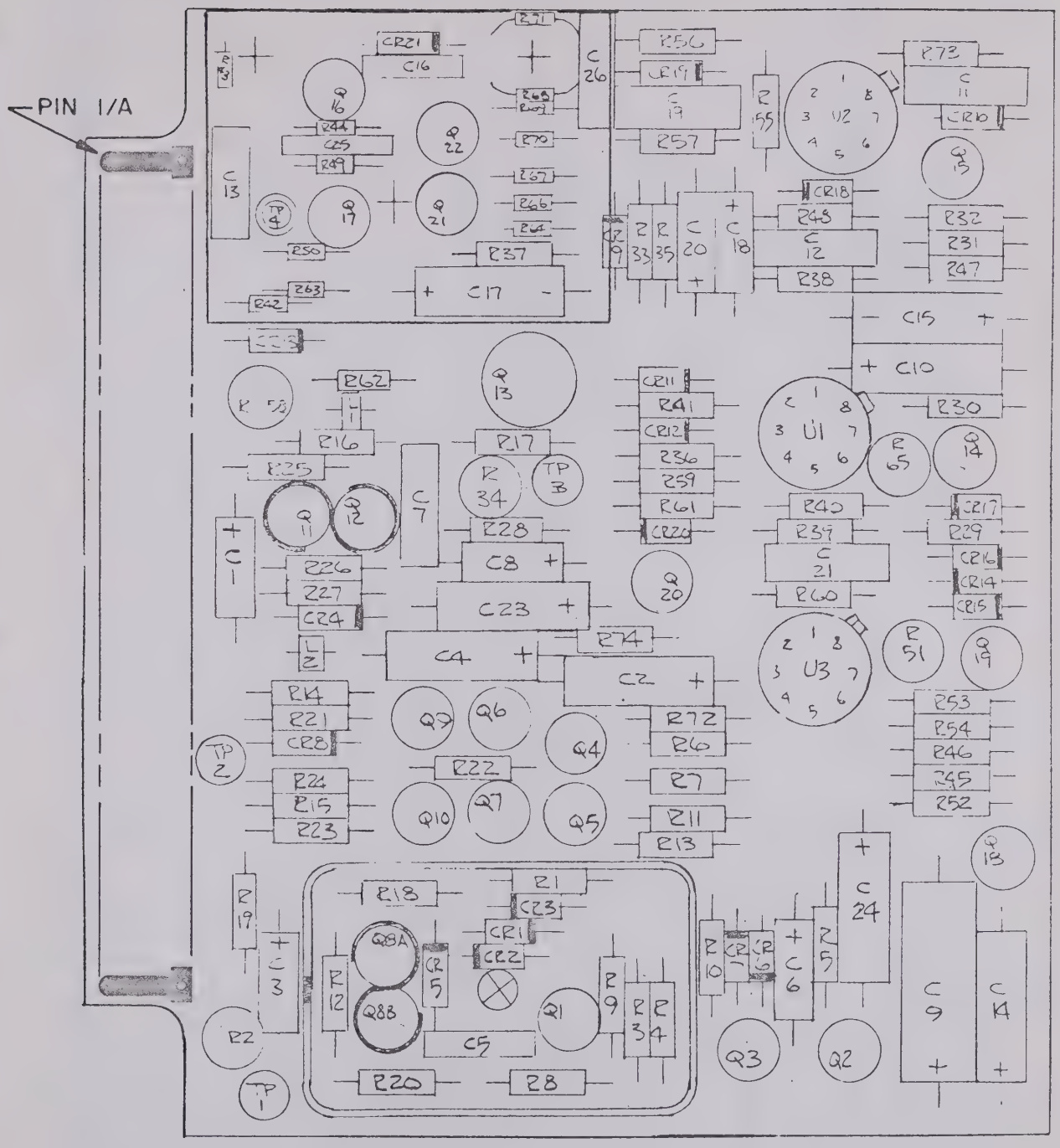


Figure 5-1. Model 4130 Basic Unit Assembly Diagram



EMR Drawing No. 10860, Rev. B

Figure 5-2. Model 4134 Limiter Card Assembly Diagram

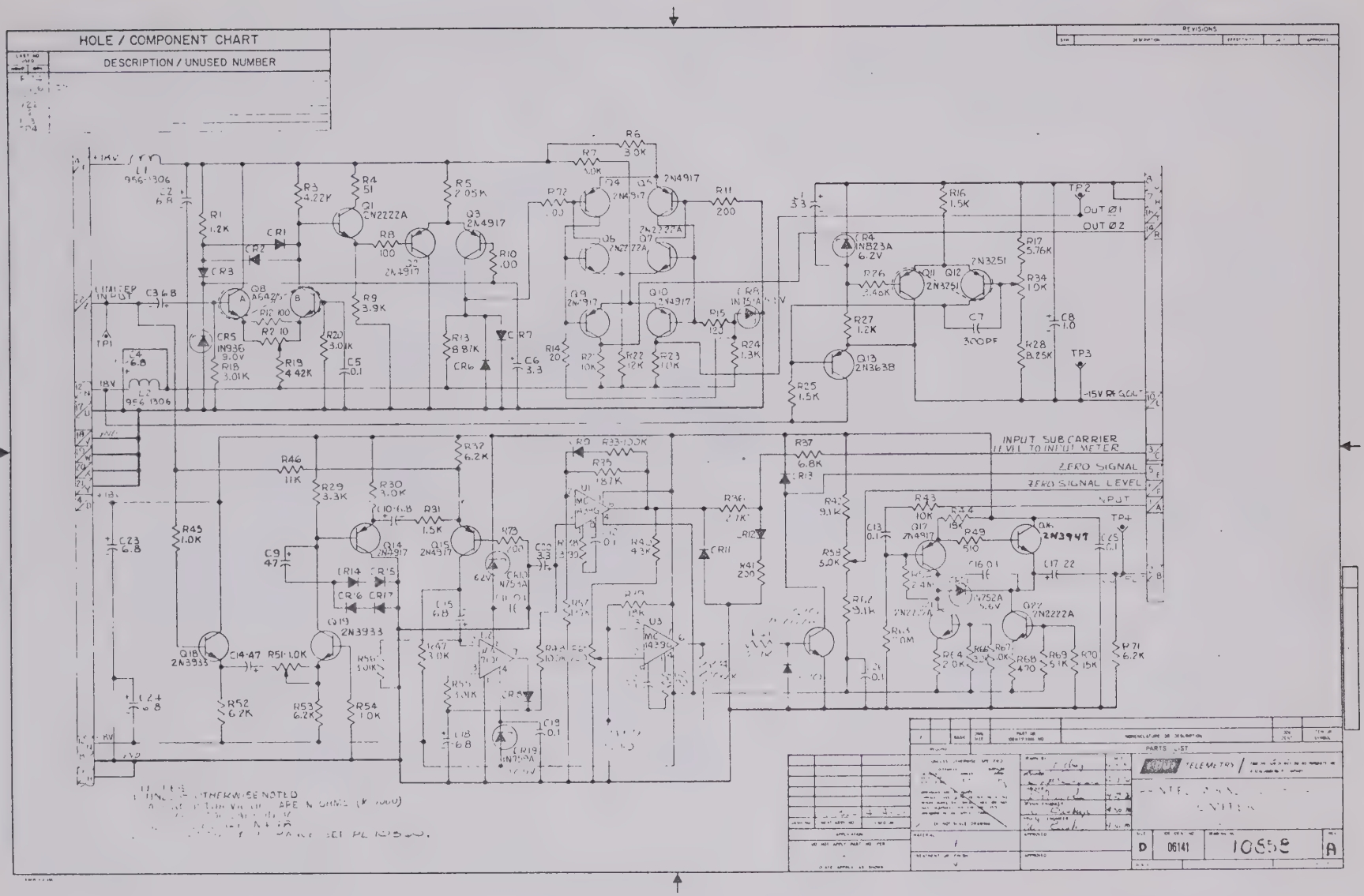


Figure 5-3. Model 4134 Limiter Card Schematic Diagram

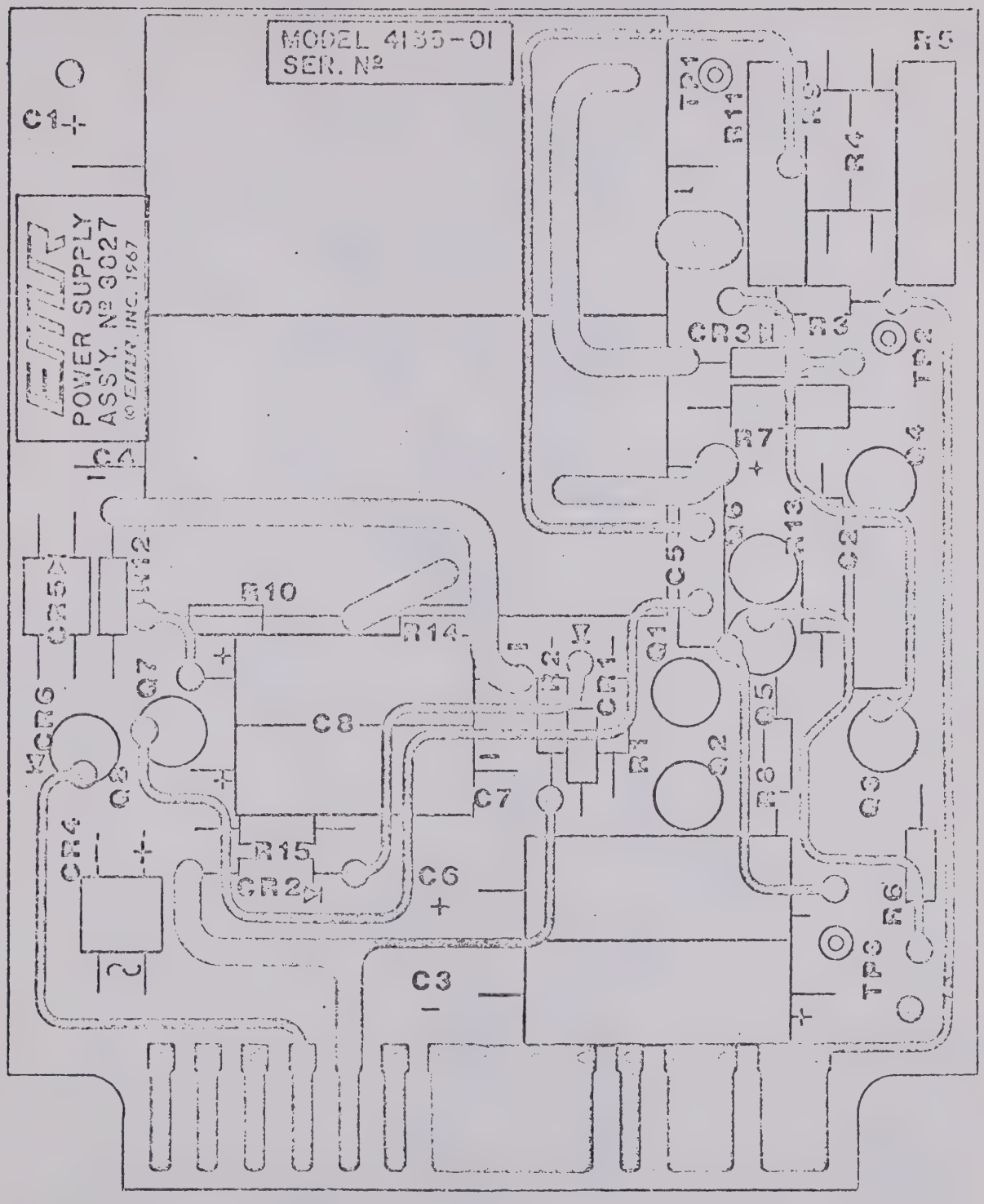
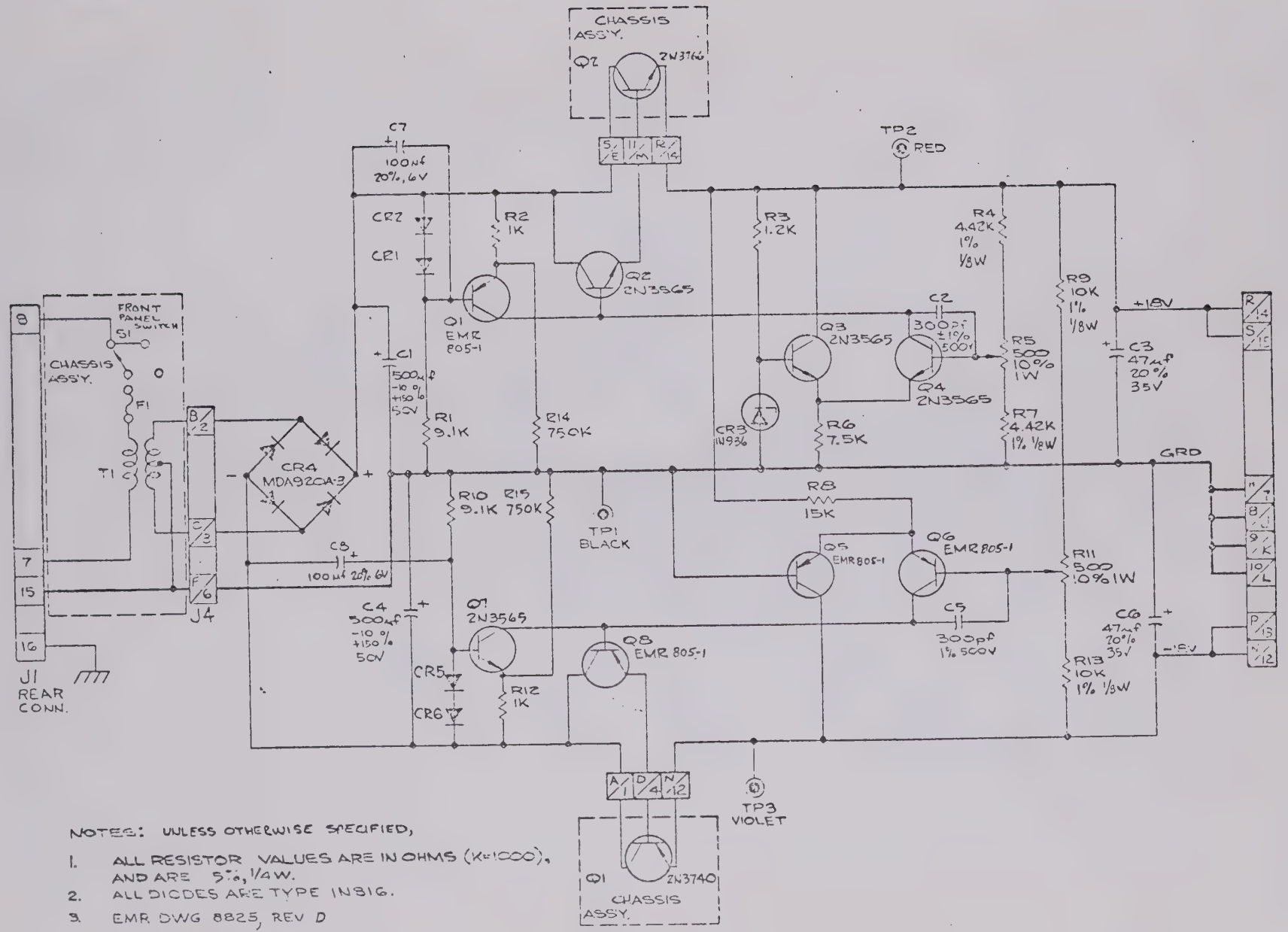


Figure 5-4. Model 4135 Power Supply Card Assembly Diagram



NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL RESISTOR VALUES ARE IN OHMS (K=1000), AND ARE 5%, 1/4 W.
2. ALL DIODES ARE TYPE IN916.
3. EMR DWG 8825, REV D

Figure 5-5. Model 4135 Power Supply Card Schematic Diagram

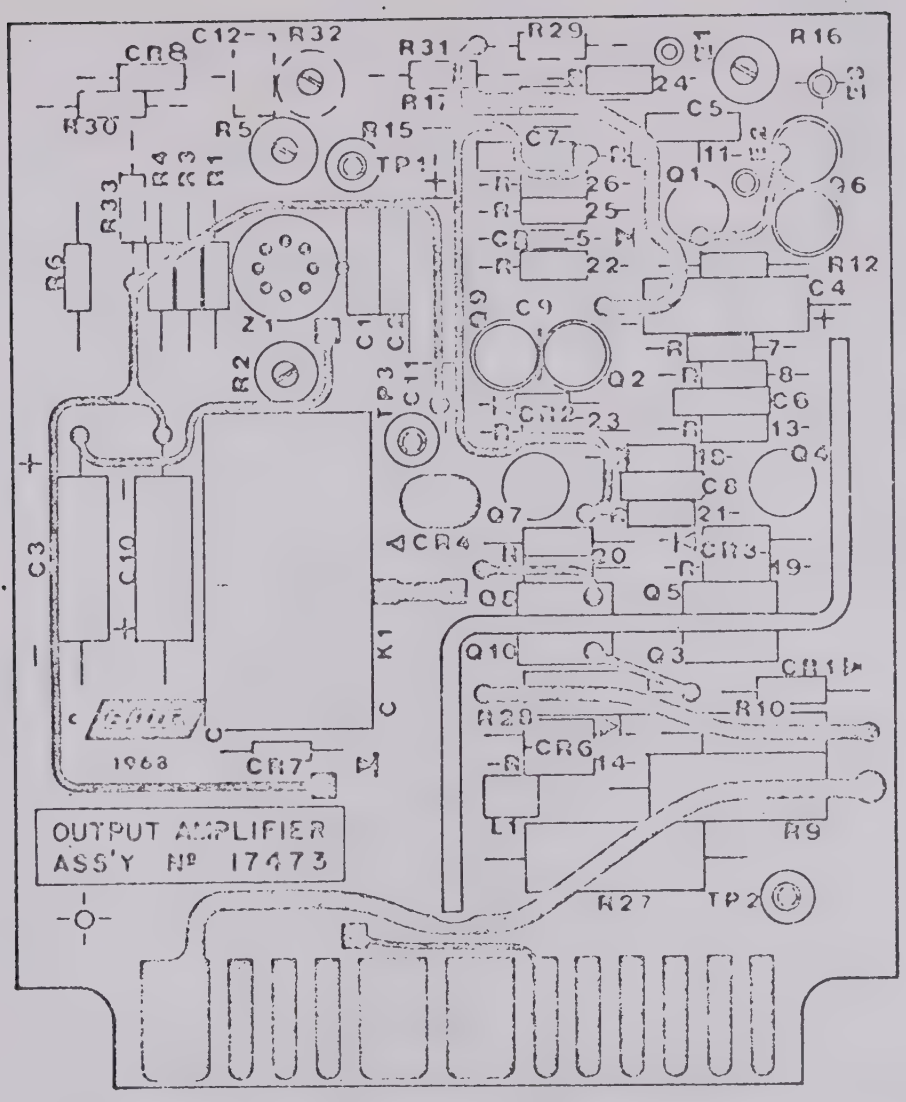


Figure 5-6. Model 4136 Output Amplifier Card Assembly Diagram

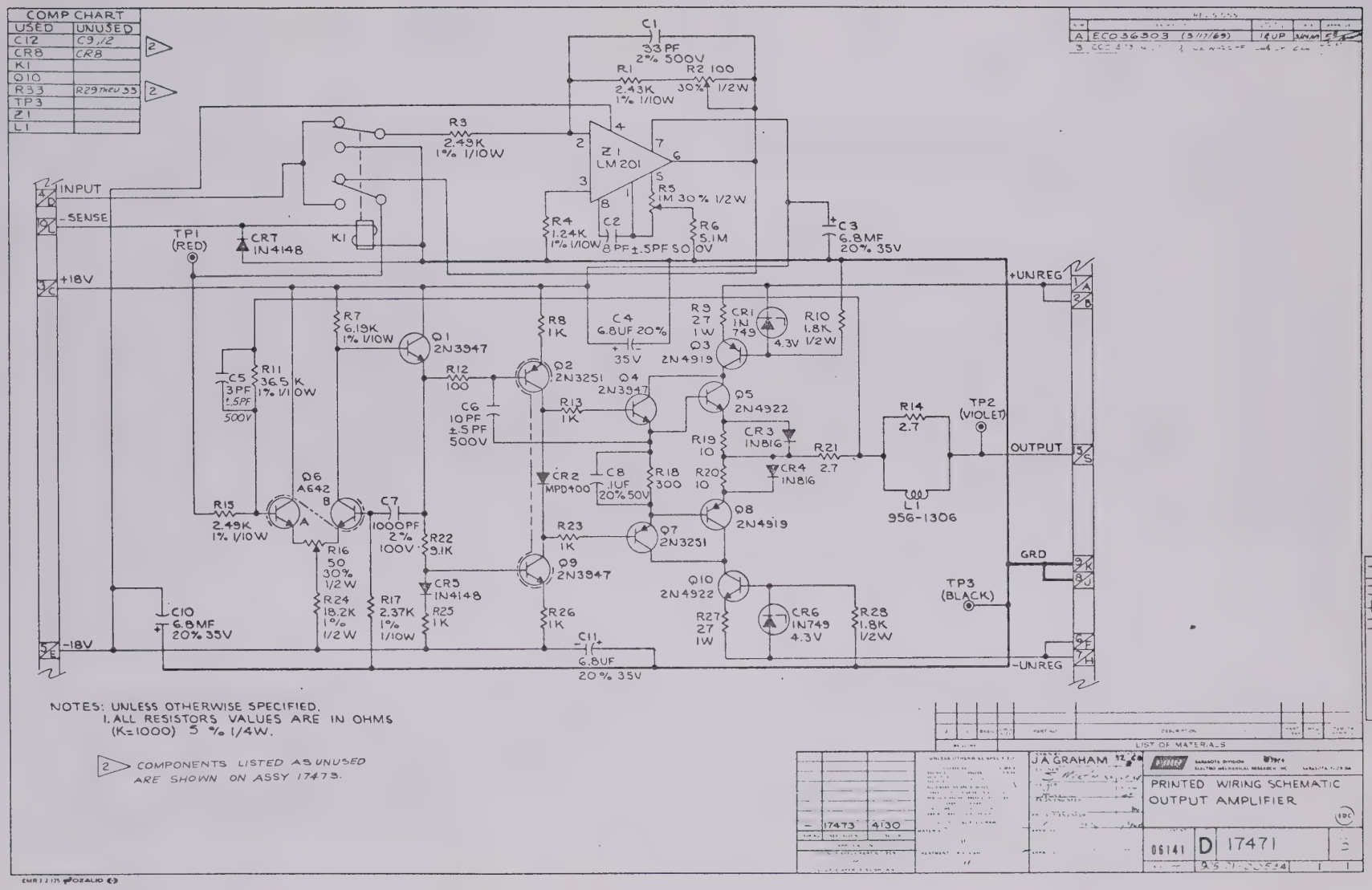


Figure 5-7. Model 4136 Output Amplifier Card Schematic Diagram

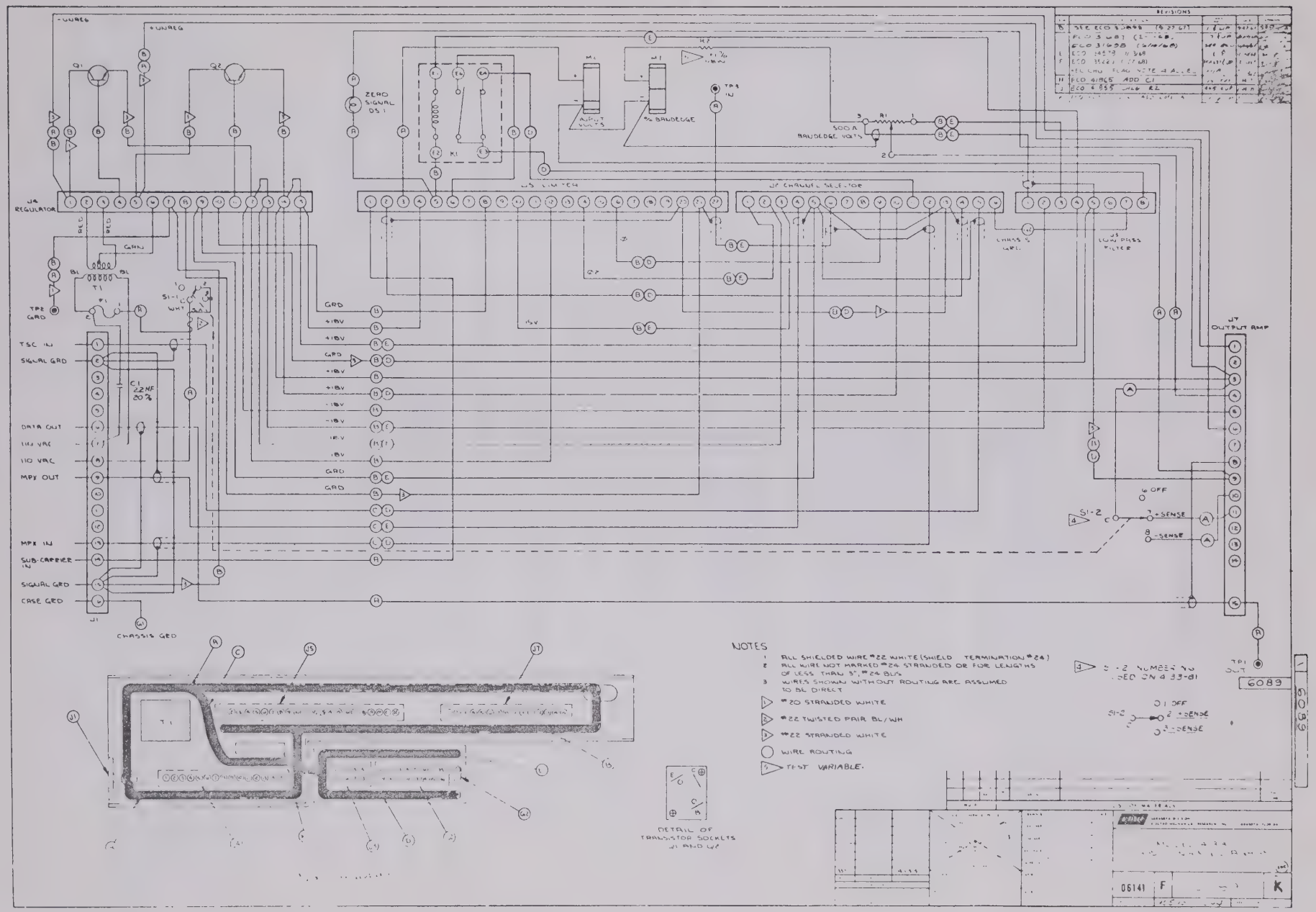


Figure 5-8. Model 4130 Basic Unit Wiring Diagram

SECTION 6

REPLACEABLE PARTS LIST AND RECOMMENDED SPARES

6.1 GENERAL

This section contains a tabular listing of the electrical and mechanical parts for the Model 4130 Basic Unit. Parts information pertinent to the plug-in Model 4131 Channel Selectors and Model 4137 Output Filters are contained in Sections 7 and 8, respectively, or in appendices of this manual.

Each major assembly of the Model 4130 Basic Unit is listed in the DESCRIPTION column of Table 6-1. Tables 6-2 through 6-5 contain a parts breakdown of the major assemblies. (The physical location of the major assemblies is shown in Figure 5-1.) Other columns in the parts list tables include EMR Stock Number, Manufacturer's Code (identified in Table 6-6), Manufacturer's Part Number, Total Quantity (TQ) used in the unit, and Recommended Spares (RS).

The recommended spares as listed in the parts list tables are based on the following listed conditions. (Paragraph 6.2 describes various other considerations for use as an aid in determining individual provisioning requirements.)

1. Operating time -- 8 hours/day, 5 days/week (2080 hours/year).
2. Operating temperature -- $0^{\circ}C$ to $30^{\circ}C$.
3. User has capability to repair to the component level.
4. Failure rates are constant.
5. A 0.9 probability of being able to repair from the recommended complement for one year.
6. Equipment will be used as ground equipment (as opposed to vehicular or airborne).

6.2 PROVISIONING CONSIDERATIONS

The selection of an optimum spare parts complement involves a number of considerations known only to the user. These considerations include operating time and cycles, operating environment, number of equipments to be spared and their locations with respect to one another, urgency of returning an equipment to service, trouble-shooting, repair and test capability, stock of commonly used parts, etc.

Sparing considerations known to EMR include mean-time-between-failures for parts and assemblies under various operating environments, prices, relative ease of troubleshooting, repair, retest, etc.

Table 6-7 lists the type of information required in order for EMR to recommend an optimum spare parts complement for specific operating and logistic situations.

If the information outlined in Table 6-7 is supplied to EMR, a recommended list will be furnished at no cost for each individual situation.

6.3 ORDERING INSTRUCTIONS

When ordering parts, complete description of each part as listed in DESCRIPTION column of parts list must accompany order. Also included, must be the EMR stock number and manufacturer's name and part number.

Table 6-2. Model 4133 Chassis Assembly Parts List (Ref. Figure 5-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4133-01 CHASSIS ASSEMBLY	042-89-00025	06141	8813 (Rev. B)	1		
	MODEL 4133-81 CHASSIS ASSEMBLY	042-89-00135	06141	8813-1 (Rev.)	1		
	FRONT PANEL SUBASSEMBLY	191-89-00081	06141	8823 (Rev. B)	1		
TP1 thru TP3	TEST JACK, White	143-98-00006	98291	SKT-8-White	3		
	SUBCHASSIS ASSEMBLY (Used on Model 4133-01 Chassis)	042-89-00026	06141	8814 (Rev. G)	1		
	SUBCHASSIS ASSEMBLY (Used on Model 4133-81 Chassis)	042-89-00136	06141	8814-1 (Rev. A)	1		
DS1	LIGHT, 28V, 40 Ma	155-98-00011	03797	CFW-22556-06	1	1	
F1	FUSE, .5 Amp., 250V	120-98-00006	75915	312.500	1	5	
J1	CONNECTOR, Plug, 16-pin, R and P	063-98-00042	02660	26-159-16	1		
J2	CONNECTOR, Plug, 16-pin, R and P	063-98-00044	02660	26-4100-16P	1		
J3	CONNECTOR, Plug, 8-pin, R and P	063-98-00043	02660	26-4100-8P	1		
J4	CONNECTOR, Receptacle, 15-pin, PWB	063-98-00046	71785	250-15-30-171	2		
J5	CONNECTOR, Receptacle, 22-pin, PWB	063-98-00045	71785	250-22-30-171	1		
J7	Same as J4						
	PRINTED-WIRING ASSY., Relay	205-89-00239	06141	3616	1		
	(K1) Relay, 1A/1B Contacts, 18V	219-98-00007	95073	3-1911	1	1	
M1	METER, % Bandedge	170-99-00010	06141	939	1		
M2	METER, Input Volts	170-99-00011	06141	947	1		
Q1	TRANSISTOR	263-10-37400	JEDEC	2N3740	1	1	
Q2	TRANSISTOR	263-10-37660	JEDEC	2N3766	1	1	
R1	POTENTIOMETER, 500 Ohms	201-98-00071	02111	Model 162	1	1	
R2	RESISTOR, 6.65K ±1%, 1/8W	605-01-66500	06141	625	1		
S1	SWITCH, Rotary (Used on Model 4133-01 Chassis)	250-98-00121	81073	50CD36-01-2-ADJN	1		
S1	SWITCH, Rotary (Used on Model 4133-81 Chassis)	250-89-00018	06141	8009-2	1		

Table 6-2 (Cont'd.). Model 4133 Chassis Assembly Parts List (Ref. Figure 5-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
T1	TRANSFORMER, Primary, 117V, 50-400 Hz (Model 4133-01 Chassis)	262-99-00050	06141	8850	1		
T1	TRANSFORMER, Primary, 207/253V, 60 Hz (Model 4133-81 Chassis)	262-99-00097	06141	8850-1	1		
XF1	FUSE HOLDER, .25 x 1.25 Fuse	134-98-00006	75915	342004 or 342028	1		
	KNOB, Light Green (For S1)	148-99-00014	06141	6076	1		
	KNOB, Dark Green (For S1)	148-99-00022	06141	6076-1	1		
	KNOB, Black (For S1)	148-99-00023	06141	6076-2	1		

Table 6-3. Model 4134-01 Limiter Card Assembly Parts List (Ref. Figure 5-2)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4134-01 LIMITER CARD ASSEMBLY	205-89-00975	06141	10860(Rev. __)	1		
C1	CAPACITOR, 3.3 Mf ±20%, 15V	336-21-33003	06141	601	3	1	
C2	CAPACITOR, 6.8 Mf ±20%, 35V	337-23-68003	06141	601	6	1	
C3	CAPACITOR, 6.8 Mf ±20%, 6V	336-19-68003	06141	601	2	1	
C4	Same as C2						
C5	CAPACITOR, .1 Mf ±20%, 50V, LS.200	301-13-10002	72982	8121-050-651-104M	9	1	
C6	Same as C1						
C7	CAPACITOR, 300 Pf ±1%, 500V	304-20-30009	06141	600	1		
C8	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	1	1	
C9	CAPACITOR, 47 Mf ±20%, 15V	338-21-47004	06141	601	1	1	
C10	Same as C2						
C11 thru C13	Same as C5						
C14	CAPACITOR, 47 Mf ±20%, 6V	337-19-47004	06141	601	1	1	
C15	Same as C2						
C16	Same as C5						
C17	CAPACITOR, 22.0 Mf ±20%, 15V	337-21-22004	06141	601	1	1	
C18	Same as C3						
C19	Same as C5						
C20	Same as C1						
C21	Same as C5						
C23 & C24	Same as C2						
C25 & C26	Same as C5						
CR1 thru CR3	DIODE	088-10-41480	JEDEC	1N4148	15	1	
CR4	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	1	1	
CR5	DIODE, Ref. 9V/7.5 Ma	088-10-09360	04713	1N936	1	1	
CR6 & CR7	Same as CR1						
CR8	DIODE, 1N751A, Zener, 5.1V	088-99-00129	06141	642-05	1	1	
CR9	Same as CR1						
CR10	DIODE, 1N753A, Zener, 6.2V	088-99-00329	06141	642-07	1	1	

Table 6-3 (Cont'd.). Model 4134-01 Limiter Card Assembly Parts List (Ref. Figure 5-2)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
CR11 thru CR18	Same as CR1						
CR19	DIODE, 1N759A, Zener, 12.0V	088-99-00119	06141	642-13	1	1	
CR20	Same as CR1						
CR21	DIODE, 1N752A, Zener, 5.6V	088-99-00199	06141	642-06	1	1	
L1 & L2	INDUCTOR, Assy.	055-89-00001	06141	956-1306	2		
Q1	TRANSISTOR, NPN 75V, DC/UHF Ampl.	263-10-22221	07263	2N2222A	6	1	
Q2 thru Q5	TRANSISTOR	263-97-49170	07263	2N4917	9	1	
Q6 & Q7	Same as Q1						
Q8	TRANSISTOR, NPN, Mat. Pr., VBE1-VBE2	263-35-00039	73445	A642/S	1	1	
Q9 & Q10	Same as Q2						
Q11 & Q12	TRANSISTOR, PNP, Switch/Amp. 50V	263-10-32510	04713	2N3251	2	1	
Q13	TRANSISTOR	263-10-36380	JEDEC	2N3638	1	1	
Q14 & Q15	Same as Q2						
Q16	TRANSISTOR, NPN 40V, Switch/Amp.	263-10-39470	JEDEC	2N3947	1	1	
Q17	Same as Q2						
Q18 & Q19	TRANSISTOR, NPN, VHF/UHF Ampl.	263-10-39330	JEDEC	2N3933	2	1	
Q20 thru Q22	Same as Q1						
R1	RESISTOR, 1.2K ±5%, 1/4W	616-02-12000	01121	RC07GF122J	2		
R2	POTENTIOMETER, 10 Ohms ±30%, .5W	201-98-00150	73138	62PR10	1	1	
R3	RESISTOR, 4.22K ±1%, 1/10W	608-09-42200	06141	624	1		
R4	RESISTOR, 51 Ohms ±5%, 1/4W	616-02-05109	01121	RC07GF510J	1		
R5	RESISTOR, 2.05K ±1%, 1/10W	608-09-20500	06141	624	1		
R6 & R7	RESISTOR, 3K ±5%, 1/4W	616-02-30000	01121	RC07GF302J	4		
R8	RESISTOR, 100.0 Ohms ±1%, 1/10W	608-09-10009	06141	624	2		
R9	RESISTOR, 3.9K ±5%, 1/4W	616-02-39000	01121	RC07GF392J	1		
R10	Same as R8						
R11	RESISTOR, 200 Ohms ±5%, 1/4W	616-02-20009	01121	RC07GF201J	4		
R12	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	1		
R13	RESISTOR, 8.87K ±1%, 1/10W	608-09-88700	06141	624	1		
R14 & R15	RESISTOR, 120 Ohms ±5%, 1/4W	616-02-12009	01121	RC07GF121J	2		

Table 6-3 (Cont'd.). Model 4134-01 Limiter Card Assembly Parts List (Ref. Figure 5-2)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R16	RESISTOR, 1.5K ±5%, 1/4W	616-02-15000	01121	RC07GF152J	3		
R17	RESISTOR, 5.76K ±1%, 1/10W	608-09-57600	06141	624	1		
R18	RESISTOR, 3.01K ±1%, 1/10W	608-09-30100	06141	624	4		
R19	RESISTOR, 4.42K ±1%, 1/10W	608-09-44200	06141	624	1		
R20	Same as R18						
R21	RESISTOR, 1K ±5%, 1/4W	616-02-10000	01121	RC07GF102J	4		
R22	RESISTOR, 12K ±5%, 1/4W	616-02-12001	01121	RC07GF123J	1		
R23	Same as R21						
R24	RESISTOR, 1.3K ±5%, 1/4W	616-02-13000	01121	RC07GF132J	1		
R25	Same as R16						
R26	RESISTOR, 3.48K ±1%, 1/10W	608-09-34800	06141	624	1		
R27	Same as R1						
R28	RESISTOR, 8.25K ±1%, 1/10W	608-09-82500	06141	624	1		
R29	RESISTOR, 3.3K ±5%, 1/4W	616-02-33000	01121	RC07GF332J	1		
R30	Same as R6						
R31	Same as R16						
R32	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	3		
R33	RESISTOR, 100K ±5%, 1/4W	616-02-10002	01121	RC07GF104J	1		
R34	POTENTIOMETER, 1K ±30%, 1/2W	201-98-00091	73138	62PR1K	2	1	
R35	RESISTOR, 187.0K ±1%, 1/10W	608-09-18702	06141	624	1		
R36	RESISTOR, 2.7K ±5%, 1/4W	616-02-27000	01121	RC07GF272J	2		
R37	RESISTOR, 6.8K ±5%, 1/4W	616-02-68000	01121	RC07GF682J	1		
R38	RESISTOR, 390 Ohms ±5%, 1/4W	616-02-39009	01121	RC07GF391J	2		
R39	RESISTOR, 18K ±5%, 1/4W	616-02-18001	01121	RC07GF183J	1		
R40	RESISTOR, 4.3K ±5%, 1/4W	616-02-43000	01121	RC07GF432J	1		
R41	Same as R11						
R42	RESISTOR, 9.1K ±5%, 1/8W	620-02-91000	01121	RC05GF912J	1		
R43	RESISTOR, 10K ±5%, 1/8W	620-02-10001	01121	RC05GF103J	2		
R44	RESISTOR, 18K ±5%, 1/8W	620-02-18001	01121	RC05GF183J	1		
R45	Same as R21						
R46	RESISTOR, 11K ±5%, 1/4W	616-02-11001	01121	RC07GF113J	1		
R47	Same as R6						
R48	RESISTOR, 10K ±1%, 1/10W	608-09-10001	06141	624	1		

Table 6-3 (Cont'd.). Model 4134-01 Limiter Card Assembly Parts List (Ref. Figure 5-2)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R49	RESISTOR, 510 Ohms ±5%, 1/8W	620-02-51009	01121	RC05GF511J	1		
R50	RESISTOR, 2.4 Meg ±5%, 1/8W	620-02-24003	01121	RC05GF245J	1		
R51	Same as R34						
R52 & R53	Same as R32						
R54	Same as R21						
R55 & R56	Same as R18						
R57	RESISTOR, 13.7K ±1%, 1/10W	608-09-13701	06141	624	1		
R58	POTENTIOMETER, 5K ±30%, 1/2W	201-98-00093	73138	62PR5K	1	1	
R59	RESISTOR, 10 Ohms ±5%, 1/4W	616-02-01009	01121	RC07GF100J	1		
R60	Same as R38						
R61	Same as R36						
R62	RESISTOR, 9.1K ±5%, 1/8W	620-02-91000	01121	RC05GF912J	1		
R63	RESISTOR, 2.0 Meg ±5%, 1/8W	620-02-20003	01121	RC05GF205J	1		
R64	RESISTOR, 2K ±5%, 1/8W	620-02-20000	01121	RC05GF202J	1		
R65	POTENTIOMETER, 200 Ohms ±30%, 1/2W	201-98-00062	73138	62PR200	1	1	
R66	RESISTOR, 3.0K ±5%, 1/8W	620-02-30000	01121	RC05GF302J	1		
R67	Same as R43						
R68	RESISTOR, 470 Ohms ±5%, 1/8W	620-02-47009	01121	RC05GF471J	1		
R69	RESISTOR, 5.1K ±5%, 1/8W	620-02-51000	01121	RC05GF512J	1		
R70	RESISTOR, 15K ±5%, 1/8W	620-02-15001	01121	RC05GF153J	1		
R71	RESISTOR, 6.2K ±5%, 1/8W	620-02-62000	01121	RC05GF622J	1		
R72 & R73	Same as R11						
R74	RESISTOR, 200K ±5%, 1/4W	616-02-20002	01121	RC07GF204J	1		
TP1 thru TP4	JACK, Test, White	143-98-00023	74970	105-851	4		
U1	INTEGRATED CIRCUIT, Op. Amp. 18V	046-16-00014	04713	MC1439G	2	1	
U2	INTEGRATED CIRCUIT	046-18-00001	07263	U5B771039X	1	1	
U3	Same as U1						

Table 6-4. Model 4135-01 Power Supply Card Assembly Parts List (Ref. Figure 5-4)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4135-01 POWER SUPPLY CARD ASSEMBLY	205-89-00089	06141	8827 (Rev. D)	1		
C1	Capacitor, 500 Mf −10 + 150%, 50V	365-06-50005	14655	BR500-50	2	1	
C2	Capacitor, 300 Pf ±1%, 500V	304-20-30009	06141	600	2		
C3	Capacitor, 47 Mf ±20%, 35V	339-23-47004	06141	601	2	1	
C4	(Same as C1)						
C5	(Same as C2)						
C6	(Same as C3)						
C7 & C8	Capacitor, 100 Mf ±20%, 6V	338-19-10005	06141	601	2	1	
CR1 & CR2	Diode	088-99-00169	06141	663	2	1	
CR3	Diode, Ref., 9V/7.5 Ma, .005%	088-10-09360	04713	1N936	1	1	
CR4	Rectifier	214-98-00003	04713	MDA920A-3	1	1	
CR5 & CR6	Diode	088-99-00169	06141	663	2		
Q1	Transistor	263-99-00139	06141	805-1	1	1	
Q2, Q3, Q4	Transistor	263-10-35650	JEDEC	2N3565	3	1	
Q5 & Q6	Transistor	263-99-00139	06141	805-1	2		
Q7	Transistor	263-10-35650	JEDEC	2N3565	1		
Q8	Transistor	263-99-00139	06141	805-1	1		
R1	Resistor, 9.1K ±5%, 1/4W	616-02-91000	01121	RC07GF912J	2		
R2	Resistor, 1K ±5%, 1/4W	616-02-10000	01121	RC07GF102J	2		
R3	Resistor, 1.2K ±5%, 1/4W	616-02-12000	01121	RC07GF122J	1		
R4	Resistor, 4.42K ±1%, 1/8W	605-09-44200	06141	625	2		
R5	Potentiometer, 500 Ohms ±10%, 1W	201-98-00014	74868	2600-501 BS1066	2	1	
R6	Resistor, 7.5K ±5%, 1/4W	616-02-75000	01121	RC07GF752J	1		
R7	(Same as R4)						
R8	Resistor, 15K ±5%, 1/4W	616-02-15001	01121	RC07GF153J	1		
R9	Resistor, 10K ±1%, 1/8W	605-09-10001	06141	625	2		
R10	(Same as R1)						
R11	(Same as R5)						

Table 6-4 (Cont'd.). Model 4135-01 Power Supply Card Assembly Parts List (Ref. Figure 5-4)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R12	(Same as R2)						
R13	(Same as R9)						
R14 & R15	Resistor, 750K ± 5%, 1/4W	616-02-75002	01121	RC07GF754J	2		
	Jack, Test, Violet	143-98-00015	74970	105-862	1		
	Jack, Test, Red	143-98-00009	74970	105-852	1		
	Jack, Test, Black	143-98-00010	74970	105-853	1		

Table 6-5. Model 4136-01 Output Amplifier Card Assembly Parts List (Ref. Figure 5-6)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4136-01 OUTPUT AMPLIFIER CARD ASSEMBLY	205-89-00706	06141	17473 (Rev. D)	1		
C1	CAPACITOR, 33 Pf ±2%, 500V	303-12-03309	06141	600	1	1	
C2	CAPACITOR, 8 Pf ±.5 Pf, 500V	304-01-00809	06141	600	1		
C3 & C4	CAPACITOR, 6.8 Mf ±20%, 35V	337-23-68003	06141	601	4		
C5	CAPACITOR, 3 Pf ±.5 Pf, 500V	304-01-00309	06141	600	1		
C6	CAPACITOR, 10 Pf ±.5 Pf, 500V	304-01-01009	06141	600	1		
C7	CAPACITOR, 1000 Pf ±2%, 100V	304-61-10000	06141	600	1		
C8	CAPACITOR, .1 Mf ±20%, 50V	301-13-10002	72982	8131-050-651-104M	1		
C10 & C11	Same as C3						
CR1	DIODE	088-99-00339	06141	642-03	2	1	
CR2	DIODE	088-19-00029	08806	MPD 400	1	1	
CR3 & CR4	DIODE	088-99-00169	06141	663	2		
CR5	DIODE	088-10-41480	JEDEC	1N4148	2		
CR6	Same as CR1						
CR7	Same as CR5						
K1	RELAY, 2 Form C Contacts	219-98-00046	27682	GP-2C-26-FCD	1	1	
L1	INDUCTOR, Assy.	055-89-00001	06141	956-1306	1		
Q1	TRANSISTOR	263-10-39470	JEDEC	2N3947	3	1	
Q2	TRANSISTOR	263-10-32510	JEDEC	2N3251	2		
Q3	TRANSISTOR	263-10-49190	JEDEC	2N4919	2	1	
Q4	Same as Q1						
Q5	TRANSISTOR	263-10-49220	JEDEC	2N4922	2	1	
Q6	TRANSISTOR	263-35-00039	73445	A642/S	1		
Q7	Same as Q2						
Q8	Same as Q3						
Q9	Same as Q1						
Q10	Same as Q5						
R1	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	1		

Table 6-5 (Cont'd.). Model 4136-01 Output Amplifier Card Assembly Parts List (Ref. Figure 5-6)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R2	POTENTIOMETER, 100 Ohms +500 PPM IT	201-98-00136	73138	62PR100	1	1	
R3	RESISTOR, 2.49K ±1%, 1/10W	608-09-24900	06141	624	2		
R4	RESISTOR, 1.24K ±1%, 1/10W	608-09-12400	06141	624	1		
R5	POTENTIOMETER, 1 Meg Ohm ±30%, 1/2W	201-98-00165	73138	62PR1M	1	1	
R6	RESISTOR, 5.1 Meg Ohms ±5%, 1/4W	616-02-51003	01121	RC07GF515J	1		
R7	RESISTOR, 6.19K ±1%, 1/10W	608-09-61900	06141	624	1		
R8	RESISTOR, 1K ±5%, 1/4W	616-02-10000	01121	RC07GF102J	5		
R9	RESISTOR, 27 Ohms ±5%, 1W	623-02-02709	01121	RC32GF270J	2		
R10	RESISTOR, 1.8K ±5%, 1/2W	622-02-18000	01121	RC20GF182J	2		
R11	RESISTOR, 36.5K ±1%, 1/10W	608-09-36501	06141	624	1		
R12	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	1		
R13	Same as R8						
R14	RESISTOR, 2.7 Ohms ±5%, 1/4W	616-02-00279	01121	RC07GF2R7J	1		
R15	Same as R3						
R16	POTENTIOMETER, 50 Ohms ±30%, 1/2W	201-98-00068	73138	62PR50	1	1	
R17	RESISTOR, 2.37K ±1%, 1/10W	608-09-23700	06141	624	1		
R18	RESISTOR, 300 Ohms ±5%, 1/4W	616-02-30009	01121	RC07GF301J	1		
R19 & R20	RESISTOR, 10 Ohms ±5%, 1/4W	616-02-01009	01121	RC07GF100J	2		
R21	Same as R14						
R22	RESISTOR, 9.1K ±5%, 1/4W	616-02-91000	01121	RC07GF912J	1		
R23	Same as R8						
R24	RESISTOR, 18.2K ±1%, 1/10W	608-09-18201	06141	624	1		
R25 & R26	Same as R8						
R27	Same as R9						
R28	Same as R10						
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
TP2	JACK, Test, Violet	143-98-00015	74970	105-862	1		
TP3	JACK, Test, Black	143-98-00010	74970	105-853	1		
Z1	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	1	1	

TABLE 6-6. MANUFACTURERS' NAMES AND CODE NUMBERS

MFR'S CODE	MFR'S NAME AND ADDRESS
00222	E. S. C. Electronics Corp., Palisades Park, N. J.
00417	Deltron, Inc., North Wales, Pa.
00779	Amp, Inc., Harrisburg, Pa.
01121	Allen-Bradley Co., Milwaukee, Wis.
01295	Texas Instrument, Inc., Semiconductor Components Div., Dallas, Texas
01686	RCL Electronics, Manchester, N. H.
01884	Dearborn Electronics, Inc., Orlando, Fla.
02111	Spectrol Electronics Corp., City of Industry, Calif.
02660	Amphenol Corp., Broadview, Ill.
02735	Radio Corp. of America, (RCA), Somerville, N. J.
02985	Tepco Electric Corp., Rochester, N. Y.
03522	McLean Engineering Labs., Princeton, N. J.
03797	Eldema Corp., Compton, Calif.
03855	Ecco Electronic Components Corp., Mt. Vernon, N. Y.
04713	Motorola Semiconductor Products, Inc., Phoenix, Ariz.
05170	Engineered Electronics Co., Inc., Santa Ana, Calif.
06141	Electro-Mechanical Research, Inc., Sarasota, Fla.
06184	Conelco Components, San Bernardino, Calif.
06540	Amathom Electronic Hdwr. Co., Inc., New Rochelle, N. Y.
07137	Transistor Electronics Corp., Minneapolis, Minn.
07263	Fairchild Camera and Instrument Corp., Mountain View, Calif.
07716	IRC, Inc., Burlington, Iowa

TABLE 6-6. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D.)

MFR'S CODE	MFR'S NAME AND ADDRESS
07994	American Radionic Co., Inc., Danbury, Conn.
08289	Delbert Blinn Co., Inc., Pomona, Calif.
08806	General Electric Co., Miniature Lamp Dept., Cleveland, Ohio
09145	Atohm Electronics, Burbank, California
09353	C and K Components, Inc., Newton, Mass.
09922	Burndy Corp., Norwalk, Conn.
10984	Chicago Dynamic Industries, Inc., Precision Products Div., Chicago, Ill.
11139	Deutsch Co., Electronic Components Div., Banning, Calif.
11920	Elasco, Inc., Boston, Mass.
12040	National Semiconductor, Danbury, Conn.
12697	Clarostat Mfg. Co., Inc., Dover, N. H.
12954	Dickson Electronics Corp., Scottsdale, Ariz.
13511	Amphenol Corp., Los Gatos, Calif.
13934	Midwec Corp., Oshkosh, Nebr.
14655	Cornell-Dubilier Electric Corp., Newark, N. J.
14749	Acopian Corp., Easton, Pa.
14752	Electro Cube, Inc., Pasadena, Calif.
15584	Riedon, North Hollywood, Calif.
15849	Useco, Inc., Mt. Vernon, N. Y.
15915	Tepro of Florida, Inc., Dunedin, Florida
16299	Corning Glass Works, Raleigh, N. C.
17276	Nexus Research Lab., Dedham, Mass.
17465	Cutler Hammer, Milwaukee, Wisconsin

TABLE 6-6. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D.)

MFR'S CODE	MFR'S NAME AND ADDRESS
18324	Signetics Corp., Sunnyvale, Calif.
19139	Eastman Kodak Co., Rochester, N. Y.
19701	Electra Mfg. Co., Independence, Kansas
22229	Union Carbide, Mountain View, Calif.
25244	Centralab Div., Glove-Union, Milwaukee, Wis.
27682	Hathaway Instruments, Inc., Denver, Colorado
28480	Hewlett-Packard Co., Palo Alto, Calif.
49956	Raytheon Co., Lexington, Mass.
55026	Simpson Electric Co., Chicago, Ill.
56289	Sprague Electric Co., North Adams, Mass.
58474	Superior Electric Corp., Bristol, Conn.
62017	United Transformer Co., New York, N. Y.
65092	Weston Instrument, Inc., Newark, N. J.
70485	Atlantic India Rubber Works, Inc., Chicago, Ill.
70903	Belden Mfg., Col, Chicago, Ill.
71279	Cambridge Thermionic Corp., Cambridge, Mass.
71450	CTS Corp., Elkhart, Ind.
71468	Cannon Electric Co., Los Angeles, Calif.
71744	Chicago Miniature Lamp Works, Chicago, Ill.
71785	Cinch Mfg. Co., Chicago, Ill.
72619	Dialight Corp., Brooklyn, N. Y.
72982	Erie Technological Products, Inc., Erie, Pa.
73138	Beckman Instruments, Inc., Fullerton, Calif.
73445	Amperex Electronic Co., Hicksville, N. Y.
73582	Kulka Corp., Mt. Vernon, N. Y.

TABLE 6-6. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D.)

MFR'S CODE	MFR'S NAME AND ADDRESS
73705	Electronic Products, Inc., Cleveland, Ohio
74193	Heinemann Electric Co., Trenton, N. J.
74545	Harvey Hubbel, Inc., Bridgeport, Conn.
74970	E. F. Johnson Co., Waseca, Minn.
75915	Littelfuse, Inc., Des Plaines, Ill.
76854	Oak Mfg. Co., Crystal Lake, Ill.
78769	E. H. Titchener and Co., Binghampton, N. Y.
80294	Bourns, Inc., Riverside, Calif.
81030	International Instruments Inc., Orange, Conn.
81073	Grayhill, Inc., La Grange, Ill.
G81349	Military Specifications Promulgated by Standardization Div. Directorate of Logistic Services DSA
81590	Korry Mfg. Co., Seattle, Wash.
82024	Ebert Electronics Corp., Long Island, N. Y.
82389	Switchcraft, Inc., Chicago, Ill.
82877	Rotron Mfg. Co., Inc., Woodstock, N. Y.
83594	Burroughs Corp., Plainfield, N. J.
84171	Arco Electronics, Inc., Great Neck, N. Y.
85604	Kepco, Inc., Flushing, New York
90201	Mallory Capacitor Co., Indianapolis, Ind.
91506	Augat, Inc., Attleboro, Mass.
91737	Gremar Mfg. Co., Inc., Wakefield, Mass.
93332	Sylvania Electric Prod., Inc., Semiconductor Div., Woburn, Mass.

TABLE 6-6. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D.)

MFR'S CODE	MFR'S NAME AND ADDRESS
94412	Dressen Barnes Electronic Corp., Pasadena, Calif.
95073	Douglas Randall, Inc., Westerly, R. I.
95146	Alco Electronics Mfg. Co., Lawrence, Mass.
95238	Continental Connector Corp., Woodside, N. Y.
95275	Vitramon, Inc., Bridgeport, Conn.
95692	Artisan Electronics Corp., Parisppany, N. J.
96182	Master Specialties Co., Costa Mesa, Calif.
96602	Dale Electronics, Inc., Columbus, Neb.
97564	Clare-Pendar, Inc., Post Falls, Idaho
98291	Sealectro Corp., Mamaroneck, N. Y.
99699	Filtors, Inc., East Northport, N. Y.
99800	Delevan Electronics Corp., Aurora, N. Y.

Table 6-7. Customer Provisioning Questionnaire

1. Equipment to be spared
   Model No.(s): _____
   Serial No.(s): _____

2. Number of equipments to be spared in each location _____

3. Operating time and cycle: _____ hours/day, _____ days/week.

4. Operating Environment:

   A. Temperature: _____
   B. Humidity: _____
   C. Altitude: _____
   D. Shock and Vibration: _____

5. Non-operating Environment: _____

   A. Temperature: _____
   B. Humidity: _____
   C. Altitude: _____

6. Desired probability of being able to spare from complement _____ percent for _____ months.

7. Can usage permit troubleshooting to parts level when a failure occurs? _____

8. What spare assemblies do you have that are used in this Model Equipment? _____

9. Do you wish us to exclude the EMR warranty period? _____

SECTION 7

EMR MODEL 4131 CHANNEL SELECTORS

7.1 INTRODUCTION

The Model 4131 Channel Selectors are used to establish the subcarrier channel parameters for the EMR 4130 Discriminator. Two basic types of Channel Selectors are available, one which is used with a Model 4130 Basic Unit and a Model 4137 Output Filter to form a data discriminator, and a second which is used only with a Model 4130 Basic Unit to form a reference discriminator.

The Model 4131 is a plug-in type unit which mounts in a Model 4130 Basic Unit. The two basic types of channel selectors are shown in the assembly diagram , Figure 7-1.

Several versions of the data channel selectors for use in subcarrier discriminator configurations are available. These units all perform the same general function but differ in overall capability. Each version of the available channel selectors is described in separate paragraphs of this section.

A complete list of all available channel selectors including a brief description of each type and the model number identification is contained in Tables 2-3 and 2-4 of this manual.

7.2 MODEL 4131-01 CHANNEL SELECTOR

7.2.1 General

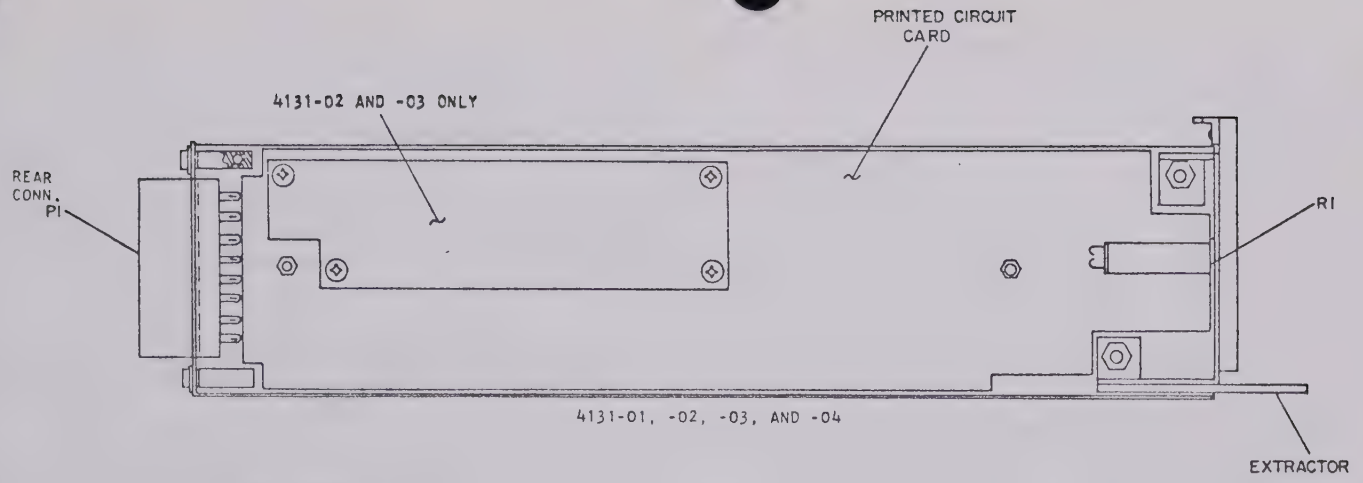
This channel selector contains a bandpass input filter, tape-speed compensation capability, and pulse-averaging type FM detector. The unit is available for operation at any single subcarrier frequency from 300 Hz through 2 MHz and at any single deviation setting from ±2.5% through ±20%. The center frequency deviation parameters are stamped on the front panel of the unit.

7.2.2 Electrical Description

The electrical configuration of the channel selector is illustrated in Figure 7-2. A description of the individual circuit areas of the channel selector is contained in the following paragraphs with reference to the detailed block diagram, Figure 7-2.

7.2.2.1 Bandpass Input Filter (BPIF)

The BPIF is tuned to extract a single subcarrier channel from an FM multiplex of subcarrier channels. Either a 6-pole pair linear-phase active RC filter or a 6-pole pair linear-phase stagger-tuned passive filter is included depending upon



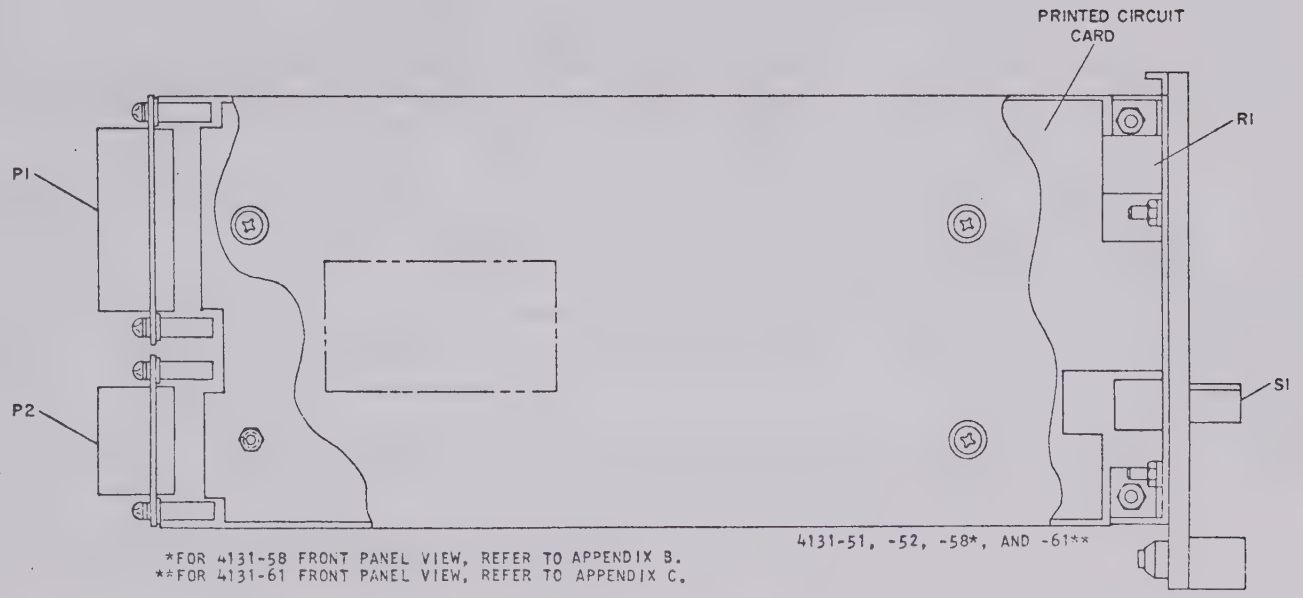
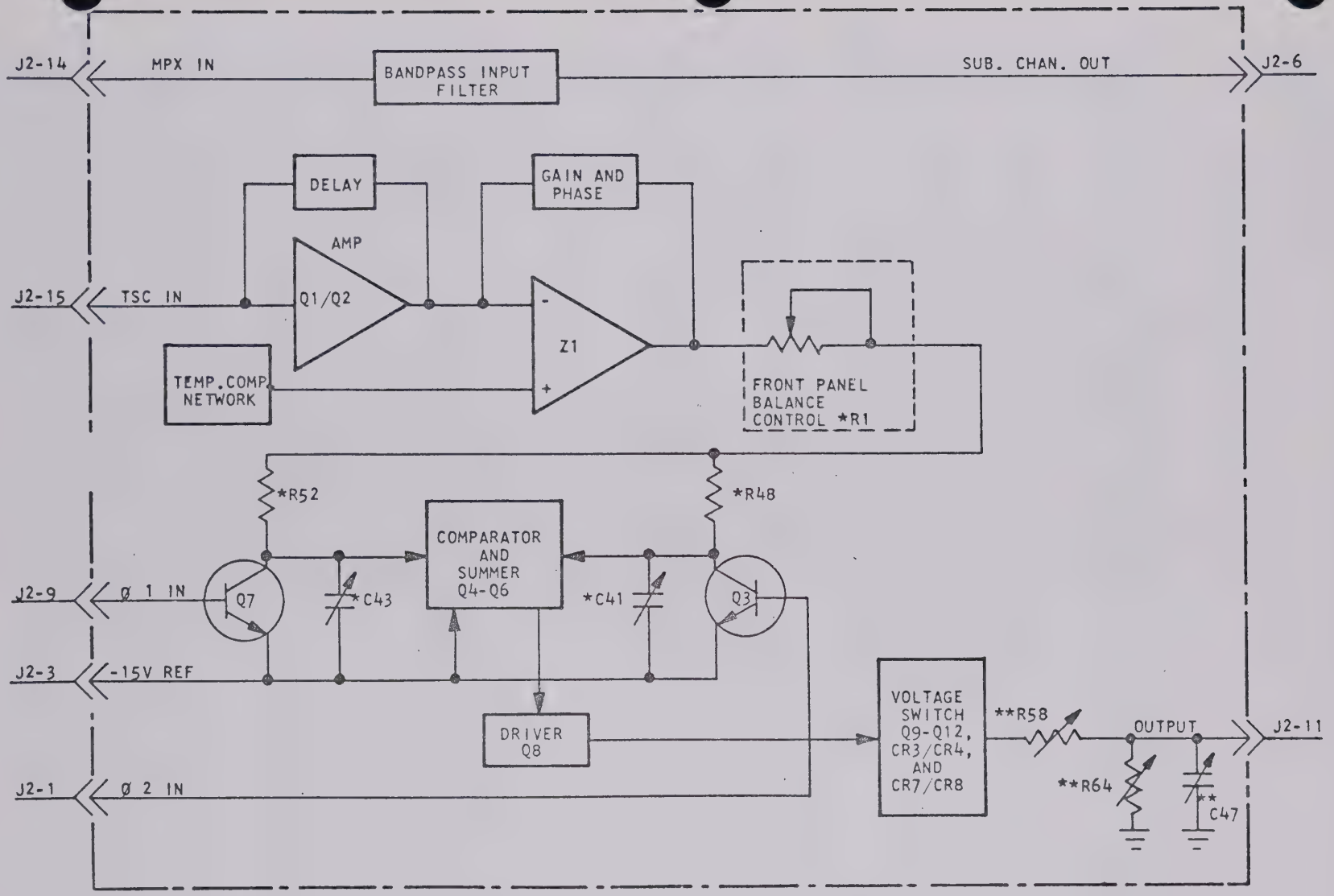


Figure 7-1. Model 4131 Channel Selector Assembly Diagram



NOTES:

1. * VALUES ESTABLISHED BY SELECTED CENTER FREQ.
2. ** VALUES ESTABLISHED BY SELECTED DEVIATION.
3. DRAWING CONTROL NO. 4130-005

Figure 7-2. Model 4131 Channel Selector Detailed Block Diagram

the selected center frequency. For center frequencies of less than 5 KHz, the BPIF is an active RC filter. At 5 KHz and above, the BPIF is a stagger tuned passive filter.

7.2.2.2 Tape-Speed Compensation (TSC) and Temperature Compensation (TC) Circuit

The TSC and TC circuits actually differ in function but are combined in the same network because both circuits ultimately compensate the FM detector. Temperature variations and tape-speed errors produce similar effects on operation of the discriminator.

The TSC and TC circuits in conjunction with the front panel BALANCE control, R1, provide a source voltage for frequency determining components in the FM detector. Initially, the BALANCE control is adjusted such that the FM detector provides an output equivalent to a 0-volt data signal with a subcarrier center frequency input. When tape-speed variations and/or temperature variations occur, the source voltage from the TSC and TC circuits changes an amount necessary to compensate for the variations.

Since the TSC error input to the TSC circuit is used to compensate the FM detector, the TSC signal must occur simultaneously with the subcarrier signal input to the FM detector. When the subcarrier signal is extracted from the subcarrier multiplex, a certain amount of delay is incurred in the BPIF. This delay is dependent upon the subcarrier channel center frequency and deviation. A built-in delay network in the TSC circuit is designed to match the delay in the BPIF thereby assuring cancellation of any erroneous variations in the input signal.

7.2.2.3 FM Detector

The FM detector consists of two quarter-cycle timing circuits which operate from complementary signals from the limiter circuit in the Model 4130 Basic Unit. Complementary inputs (Ø1 and Ø2) are square wave signals representative of the subcarrier signal input to the unit with the zero crossings maintained. With a center frequency input, the zero crossings are equally spaced and correspond to the center frequency zero crossings established in the unit. When a modulation component is introduced, the time between zero crossings changes proportionally from the center frequency zero crossings standard established in the unit. The FM detector thus detects the time between zero crossings and provides an output representing the frequency input.

Each quarter-cycle detector operates on alternate half cycles of the square wave inputs (Ø1 and Ø2). A negative-going level at either input turns-off input transistors Q3, or Q7. In this condition, the appropriate timing capacitor, C41 or C43, charges toward the source voltage through R48 or R52. One quarter-cycle later, the voltage increases to a level necessary to trigger the comparator Q4 or Q6. The quarter-cycle periods differ depending upon the subcarrier channel center frequency; therefore, timing capacitors C41 and C43 are sized accordingly.

When the Ø1 or Ø2 input changes to a positive level, the appropriate input transistor is turned on and the timing capacitor discharges. This action repeats each half cycle thus providing a time measurement between zero crossings in the subcarrier signal.

The comparator outputs, Q4 and Q6, are summed by transistor Q5 and coupled through an emitter-follower driver stage Q8 to the voltage switch. Typical waveforms for the FM detector are shown in Figure 7-3. By inspecting these waveforms, it is seen that, if the subcarrier frequency increases, the positive portions of the summed output become shorter in duration than the negative portion since the negative portions are set to the fixed one-quarter cycle interval by the timing capacitors.

7.2.2.4 Voltage Switch

The voltage switch operates from the FM detector output to establish precise amplitude levels for the detected subcarrier signal. This is a cross coupled network which is triggered on every edge of the FM detector output. Zener diodes, connected to the ±18 volts regulated DC supplies, establish reference voltages of +15 volts and −15 volts. The square wave input to the voltage switch is then converted to an output signal with a ±15 volts magnitude (see waveform in Figure 7-3).

7.2.2.5 Deviation Sensitivity Components

The deviation sensitivity components are connected as a resistive voltage divider and RC integrator which converts the square wave output from the voltage switch into a triangular waveform with specific amplitude characteristics. A typical waveform is shown in Figure 7-3.

The voltage divider R58/R64 establishes the magnitude of the triangular wave output for the selected deviation of the subcarrier channel. The maximum amplitude must always be the same for full-bandwidth deviation regardless of the deviation setting of the channel selector.

7.2.3 Maintenance

Channel Selector Maintenance is divided into three catagories: general inspection, troubleshooting, and repair. An inspection should be performed periodically to ensure that all mechanical components are secured and that all electrical components including internal wiring are properly installed.

NOTE

Before replacing any defective component in the channel selector, refer to paragraph 7.2.4, Repairs.

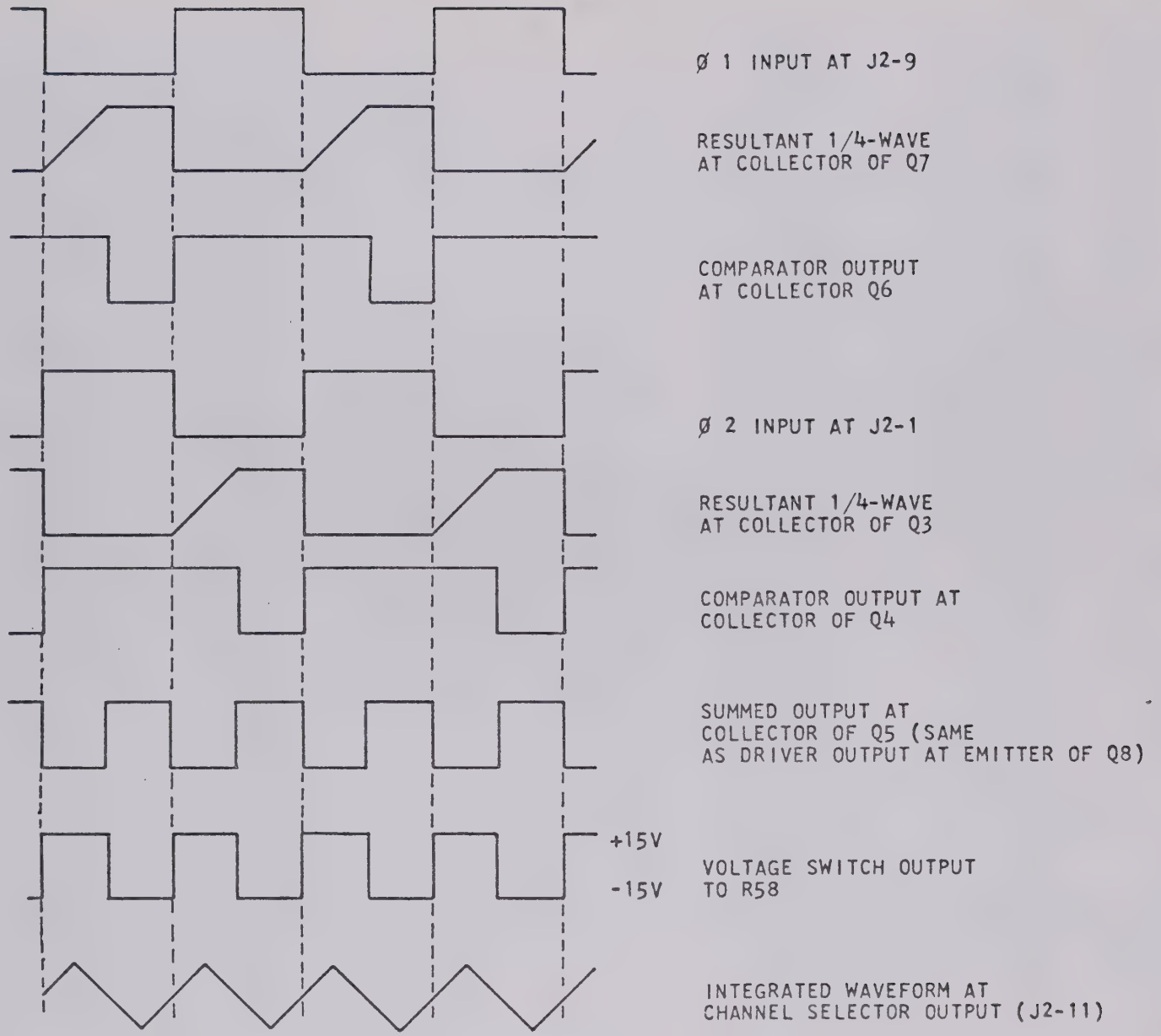


Figure 7-3. Channel Selector Waveforms

If a malfunction occurs, an inspection of the unit may indicate the problem. However, if an electrical failure occurs, troubleshooting the unit using the electrical description (para. 7.2.2), schematic and assembly diagrams (Figures 7-4 through 7-7), waveforms (Table 7-1), and transistor voltage measurements (Table 7-2) will locate the trouble.

Certain circuits of the channel selector are not field repairable; therefore, detailed troubleshooting in these circuits is not recommended. The non-field repairable circuits are: (1) Bandpass input filter; (2) TSC circuit; and (3) TC circuit. More detailed repair information concerning these circuits is contained in paragraph 7.2.4, Repairs.

7.2.4 Repairs

Repairs to the channel selector may be made only in the FM detector, voltage switch, and deviation sensitivity circuits. Components in these circuits found to be defective can be replaced without degrading unit operation. Replacement components are described in paragraph 7.2.5, Parts List.

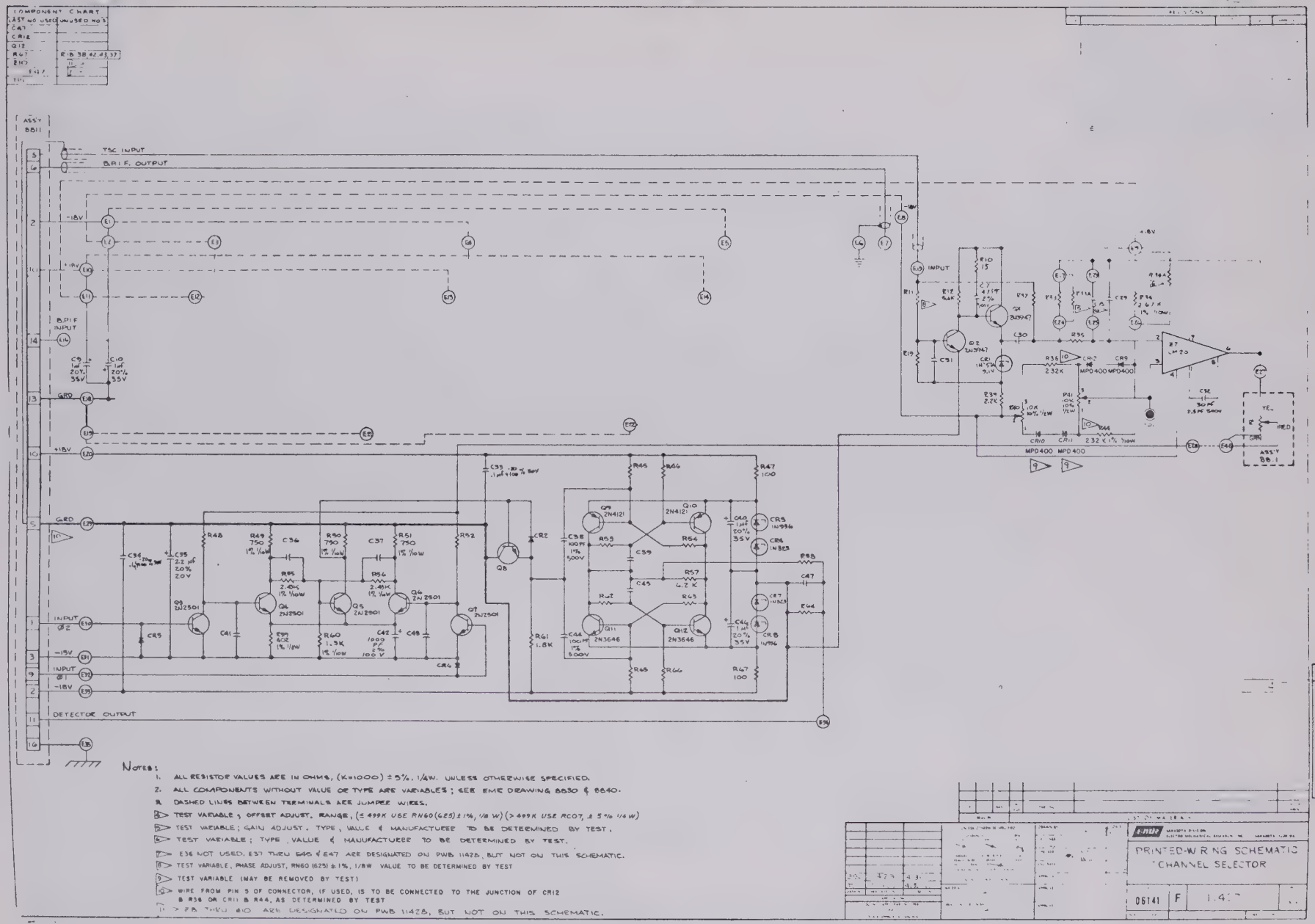
NOTE

Certain components are aged at EMR to yield optimum performance. These components must be replaced with aged components per EMR specification. When replacing any aged component, order component from EMR and specify aged component. These components are identified in the parts list.

If, when troubleshooting the channel selector, a malfunction is found to be in the BPIF, tape-speed compensation, or temperature compensation circuits, return the unit to EMR for repair and readjustment.

7.2.5 Parts List

The parts lists for the Model 4131-01 are contained in Tables 7-3, 7-4, and 7-5. Table 7-3 is the overall assembly parts list for this channel selector. Tables 7-4 and 7-5 contain parts information for the two printed-circuit card assemblies. The particular card used in the channel selector is determined by the subcarrier center frequency. Diagrams in which the components of the parts lists are shown are referenced in the table title. Information describing the parts list breakdown, parts provisioning, and ordering information is contained in Section 6 of this manual.



NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS, (K=1000) ±5%, 1/4W. UNLESS OTHERWISE SPECIFIED.
2. ALL COMPONENTS WITHOUT VALUE OR TYPE ARE VARIABLES; SEE EMR DRAWING 8830 & 8840.
3. DASHED LINES BETWEEN TERMINALS ARE JUMPER WIRES.

(A) TEST VARIABLE; OFFSET ADJUST. RANGE, (± 499K USE RN60(625) ± 1%, 1/8 W) (> 499K USE RC07, ± 5% 1/4 W)

(B) TEST VARIABLE; GAIN ADJUST. TYPE, VALUE & MANUFACTUREE TO BE DETERMINED BY TEST.

(C) TEST VARIABLE; TYPE, VALUE & MANUFACTUREE TO BE DETERMINED BY TEST.

(D) E36 NOT USED. E37 THRU E46 & E47 ARE DESIGNATED ON PWB 11428, BUT NOT ON THIS SCHEMATIC.

(E) TEST VARIABLE, PHASE ADJUST, RN60 (6251 ± 1%, 1/8W VALUE TO BE DETERMINED BY TEST

(F) TEST VARIABLE (MAY BE REMOVED BY TEST)

(G) WIRE FROM PIN 3 OF CONNECTOR, IF USED, IS TO BE CONNECTED TO THE JUNCTION OF CR12 & R36 OR CR11 & R44, AS DETERMINED BY TEST

(H) > P8 THRU #10 ARE DESIGNATED ON PWB 11428, BUT NOT ON THIS SCHEMATIC.

Figure 7-4. Model 4131-01 Channel Selector Schematic Diagram
(Used for center frequencies of 5 KHz and below)

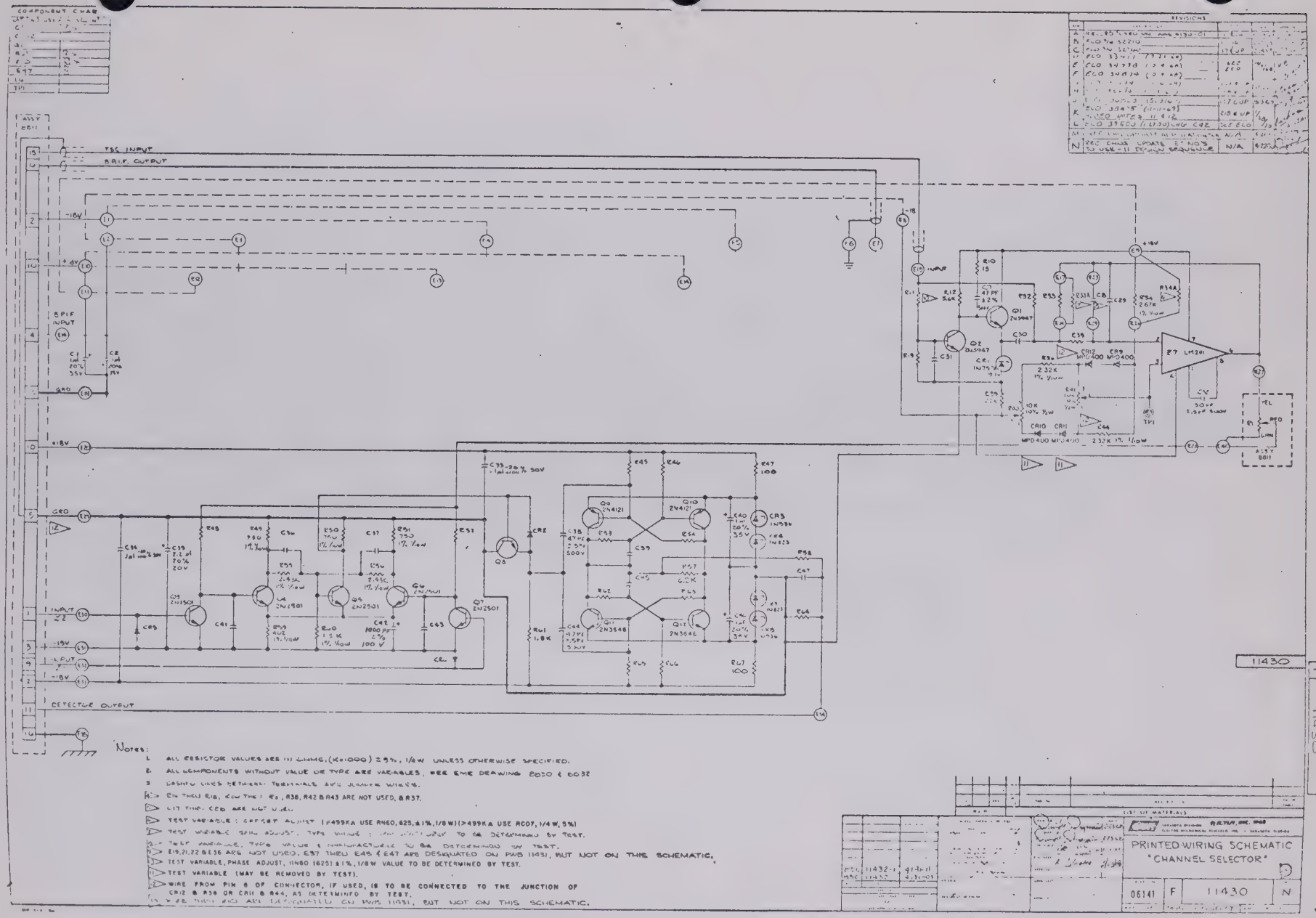
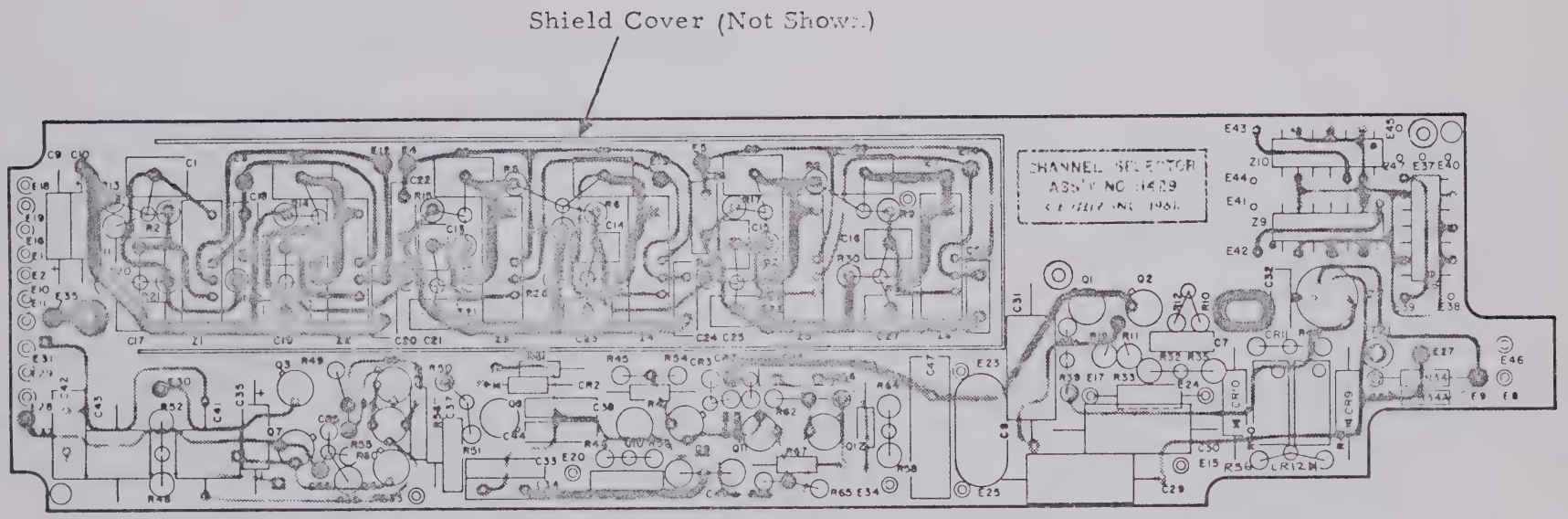


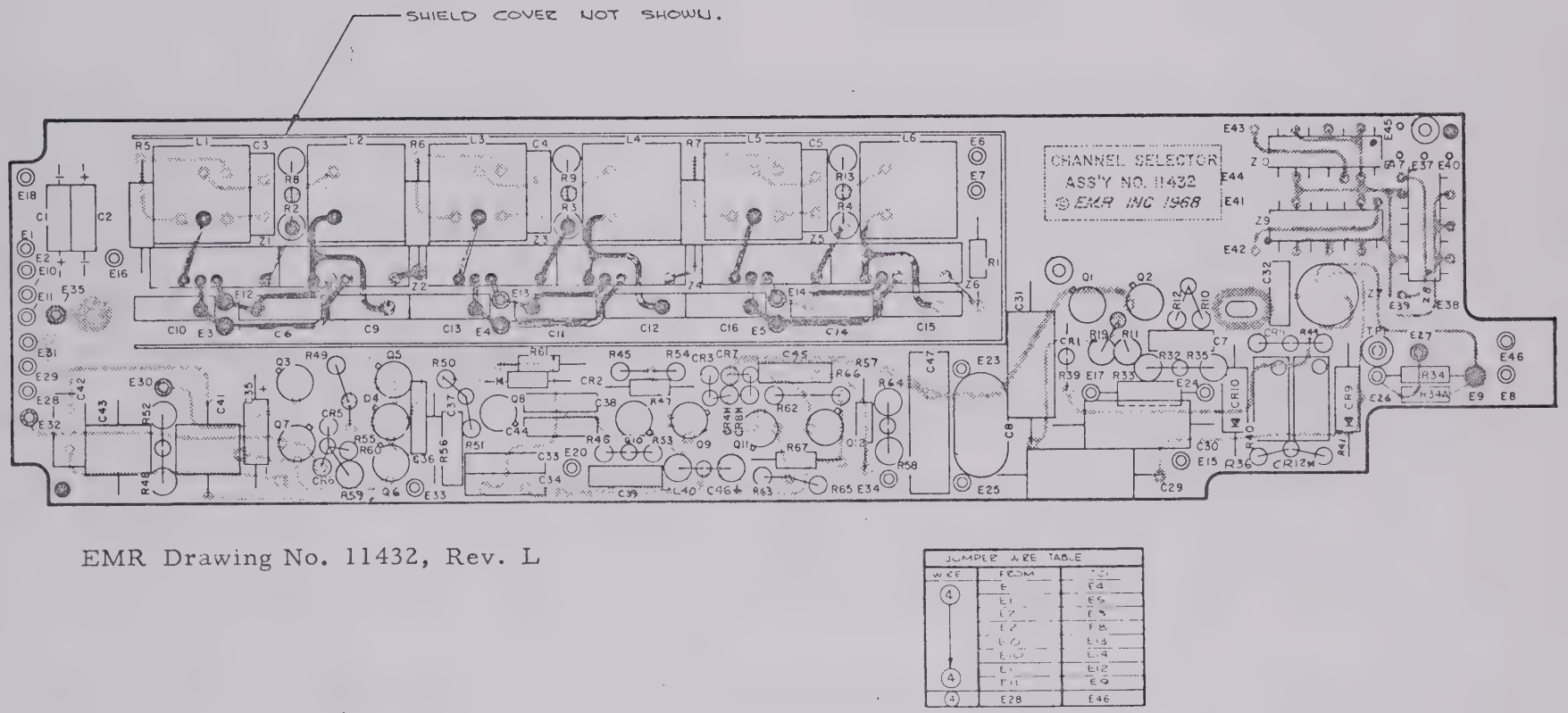
Figure 7-5. Model 4131-01 Channel Selector Schematic Diagram
(Used for center frequencies above 5 KHz)



EMR Drawing No. 11429, Rev. J

JUMPER WIRE TABLE		
WIRE	FROM	TO
4	E1	E4
	E1	E5
	E2	E3
	E7	E15
	E10	E14
	E16	E19
	E17	E18
4	E31	E39
14	E28	E46

Figure 7-6. Model 4131-01 Channel Selector Printed-Circuit Card Assembly Diagram
(Used for center frequencies of 5 KHz and below)



EMR Drawing No. 11432, Rev. L

Figure 7-7. Model 4131-01 Channel Selector Printed-Circuit Card Assembly Diagram
(Used for center frequencies above 5 KHz)

Table 7-1. Model 4131 Channel Selector Waveforms

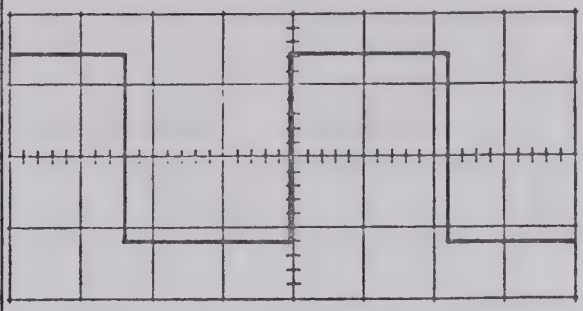
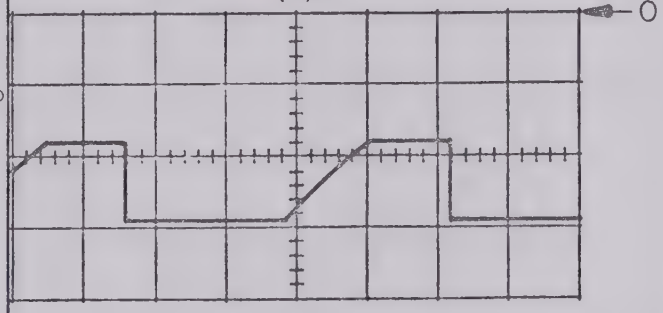
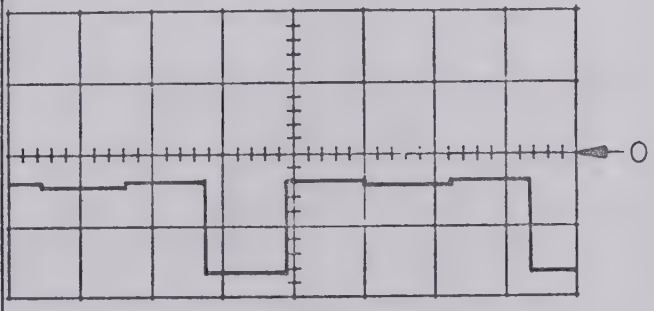
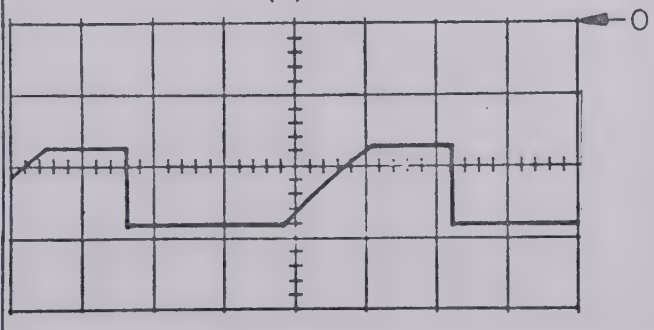
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Detector input at rear connector P1 pin 1	Center freq. sub. input to unit	(1) 	0.5V/cm centered around -15V	- - -
Collector of Q3	Center freq. sub. input to unit	(2) 	5V/cm	- - -
Collector of Q4	Center freq. sub. input to unit	(3) 	5V/cm	- - -
Collector of Q7	Center freq. sub. input to unit	(4) 	5V/cm	- - -

Table 7-1 (Cont'd.). Model 4131 Channel Selector Waveforms

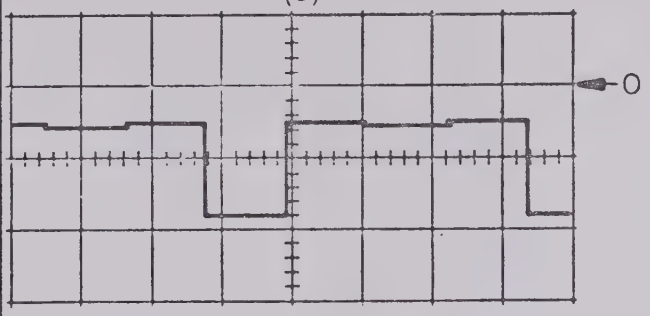
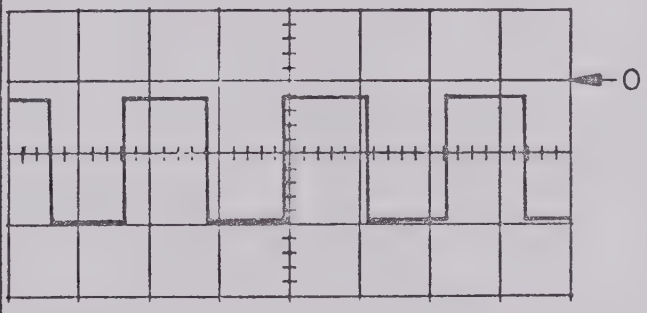
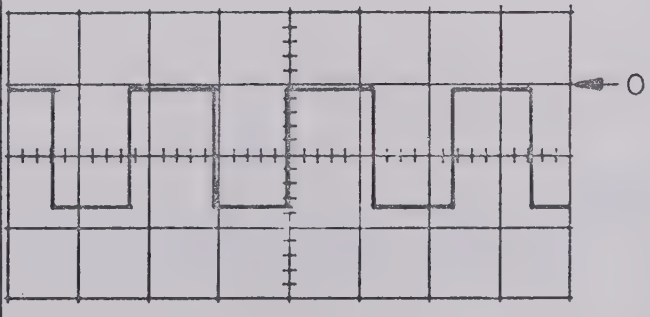
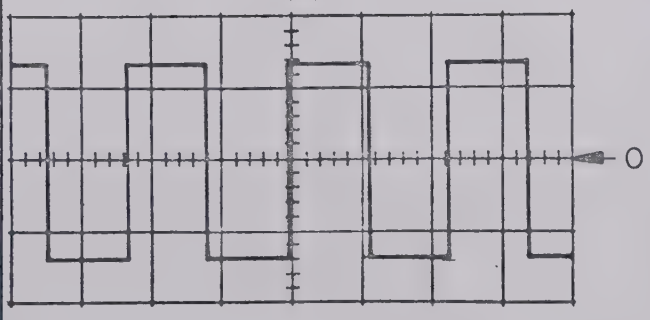
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Collector of Q6	Center freq. sub. input to unit	(5)  0	5V/cm	- - -
Collector of Q5	Center freq. sub. input to unit	(6)  0	5V/cm	- - -
Emitter of Q8	Center freq. sub. input to unit	(7)  0	5V/cm	- - -
Junction of C39/-C45	Center freq. sub. input to unit	(8)  0	10V/cm	- - -

Table 7-2. Model 4131 Channel Selector Transistor Voltage Measurements

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+9.84	+10.4	+18.0
Q2	0.00	+0.61	+10.4
Q3	-15.0	-14.2	-14.9
Q4	-9.69	-14.9	-2.45
Q5	-9.69	-10.2	-0.05
Q6	-9.69	-8.92	-9.52
Q7	-15.0	-15.6	-8.92
Q8	-9.80	-0.05	GRD
Q9	+15.1	+14.3	*
Q10	+15.1	+14.1	*
Q11	-14.7	-17.2	*
Q12	-14.7	-17.2	*

NOTES:

* These voltages cannot be measured.

1. Same conditions as Table 5-2.

2. Voltages may vary because of the cross-coupled networks. The voltages are typical for one active state.

Table 7-3. Model 4131-01 Channel Selector Parts List (Ref. Figure 7-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131 CHANNEL SELECTOR	414-89-00016	06141	8811 (Rev.C)	1		
P1	REAR CONNECTOR	063-98-00048	02660	26-4200-16S	1		
R1	FRONT PANEL POTENTIOMETER, 1K ±10%, 1W (For frequencies below 100 KHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER, 500 Ohms ±10%, 1W (For frequencies of 100 KHz and above)	201-98-00142	02660	2901-L-501M	1	1	
	PRINTED-CIRCUIT CARD (For frequencies of 5 KHz and below, See Table 7-4 for breakdown)	205-89-00206	06141	11429	1		
	PRINTED-CIRCUIT CARD (For frequencies above 5 KHz, See Table 7-5 for breakdown)	205-89-00207	06141	11432	1		

Table 7-4. Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies of 5 KHz and below; ref. Figure 7-6.)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	CHANNEL SELECTOR, Printed-Wiring Assy.	205-89-00206	06141	11429 (Rev. M)	1		
C1 thru C6	CAPACITOR, Frequency Variable	999-01-00023	06141	8840	6		
C7	CAPACITOR, 47 Pf ±2%, 500V	304-12-04709	06141	600	1		
C8	CAPACITOR, Test Variable	000-00-00000			1		
C9 & C10	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	4		
C11 thru C17	CAPACITOR, Frequency Variable	999-01-00024	06141	8840	12		
C18	CAPACITOR, 0.1 Mf -20 or +100%, 30V	387-01-10002	25244	DA-104	8	1	
C19	(Same as C11)						
C20	(Same as C18)						
C21	(Same as C11)						
C22	(Same as C18)						
C23	(Same as C11)						
C24	(Same as C18)						
C25	(Same as C11)						
C26	(Same as C18)						
C27	(Same as C11)						
C28	(Same as C18)						
C29	CAPACITOR, Frequency Variable	999-01-00007	06141	8830	1		
C30 & C31	CAPACITOR, Frequency Variable	999-01-00006	06141	8830	2		
C32	CAPACITOR, 30 Pf ±0.5 Pf, 500V	304-08-03009	06141	600	1		
C33 & C34	(Same as C18)						
C35	CAPACITOR, 2.2 Mf ±20%, 20V	336-22-22003	06141	601	1	1	
C36 & C37	CAPACITOR, Frequency Variable	999-01-00016	06141	8830	2		
C38	CAPACITOR, 100 Pf ±1%, 500V	304-20-10009	06141	600	2		
C39	CAPACITOR, Frequency Variable	999-01-00017	06141	8830	2		
C40	(Same as C9)						
C41	CAPACITOR, Frequency Variable (Aged)	999-01-00004	06141	8830	2		
C42	CAPACITOR, 1000 Pf ±2%, 100V	304-61-10000	06141	600	1		
C43	(Same as C41)						
C44	(Same as C38)						

Table 7-4 (Cont'd.). Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies of 5 KHz and below; ref. figure 7-6.)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
C45	(Same as C39)						
C46	(Same as C9)						
C47	CAPACITOR, Frequency Variable	999-01-00003	06141	8830	1		
CR1	DIODE, 9.1V, 400 MW	088-99-00379	06141	642-11	1	1	
CR2	DIODE, Frequency Variable	999-01-00018	06141	8830	3		
CR3	DIODE, Ref., 9V/7.5 Ma, .005%	088-10-09360	04713	1N936	2		
CR4	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	2		
CR5 & CR6	(Same as CR2)						
CR7	(Same as CR4)						
CR8	(Same as CR3)						
CR9 thru CR12	DIODE	088-19-00029	08806	MPD400	4		
Q1 & Q2	TRANSISTOR	263-10-39470	JEDEC	2N3947	2		
Q3 thru Q7	TRANSISTOR (Aged)	263-10-25010	JEDEC	2N2501	5	1	
Q8	TRANSISTOR, Frequency Variable	999-01-00019	06141	8830	1		
Q9 & Q10	TRANSISTOR	263-10-41210	JEDEC	2N4121	2	1	
Q11 & Q12	TRANSISTOR	263-10-36460	JEDEC	2N3646	2	1	
R1	RESISTOR, Frequency Variable	999-01-00001	06141	8840	1		
R2	RESISTOR, Frequency Variable	999-01-00002	06141	8840	1		
R3	RESISTOR, Frequency Variable	999-01-00003	06141	8840	2		
R4	RESISTOR, Frequency Variable	999-01-00004	06141	8840	2		
R5	RESISTOR, Frequency Variable	999-01-00005	06141	8840	1		
R6	RESISTOR, Frequency Variable	999-01-00006	06141	8840	1		
R7	RESISTOR, Frequency Variable	999-01-00007	06141	8840	2		
R8 & R9	RESISTOR, Frequency Variable	999-01-00008	06141	8840	3		
R10	RESISTOR, 15 Ohms ±5%, 1/4W	616-02-01509	01121	RC07GF150J	1		
R11	RESISTOR, Test Variable	605-09-00000	06141	8830	1		
R12	RESISTOR, 5.6K ±5%, 1/4W	616-02-56000	01121	RC07GF562J	1		
R13	RESISTOR, Frequency Variable	999-01-00009	06141	8840	1		
R14	(Same as R3)						
R15	(Same as R4)						
R16	RESISTOR, Frequency Variable	999-01-00010	06141	8840	1		

Table 7-4 (Cont'd). Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies of 5 KHz and below; ref. Figure 7-6.)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R17	(Same as R7)						
R19	RESISTOR, Frequency Variable	999-01-00012	06141	8830	2		
R20	RESISTOR, Frequency Variable	999-01-00011	06141	8840	1		
R21	(Same as R19)						
R22	RESISTOR, Frequency Variable	999-01-00013	06141	8840	1		
R23	RESISTOR, Frequency Variable	999-01-00014	06141	8840	1		
R24	RESISTOR, Frequency Variable	999-01-00015	06141	8840	1		
R25	RESISTOR, Frequency Variable	999-01-00016	06141	8840	1		
R26	RESISTOR, Frequency Variable	999-01-00017	06141	8840	1		
R27	RESISTOR, Frequency Variable	999-01-00018	06141	8840	1		
R28	RESISTOR, Frequency Variable	999-01-00019	06141	8840	1		
R29	RESISTOR, Frequency Variable	999-01-00020	06141	8840	1		
R30	RESISTOR, Frequency Variable	999-01-00021	06141	8840	1		
R31	RESISTOR, Frequency Variable	999-01-00022	06141	8840	1		
R32	(Same as R8)						
R33	RESISTOR, Frequency Variable	999-01-00009	06141	8830	1		
R33A	RESISTOR, Test Variable	000-00-00000	06141		1		
R34	RESISTOR, 2.67K ±1%, 1/10W	608-09-26700	06141	624	1		
R34A	RESISTOR, Test Variable	000-00-00000	06141		1		
R35	RESISTOR, Frequency Variable	999-01-00010	06141	8830	1		
R36	RESISTOR, 2.32K ±1%, 1/10W	608-09-23200	06141	624	2		
R39	RESISTOR, 2.2K ±5%, 1/4W	616-02-22000	01121	RC07GF222J	1		
R40 & R41	POTENTIOMETER, 10K ±10%, 1/2W	201-98-00113	80294	3255W-1-103 or 3257W	2	1	
R44	(Same as R36)						
R45 & R46	RESISTOR, Frequency Variable	999-01-00014	06141	8830	4		
R47	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	2		
R48	RESISTOR, Frequency Variable (Aged)	999-01-00013	06141	8830	2		
R49, R50, and R51	RESISTOR, 750 Ohms ±1%, 1/10W	608-09-75009	06141	624	3		
R52	(Same as R48)						
R53 & R54	RESISTOR, Frequency Variable	999-01-00015	06141	8830	4		
R55 & R56	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	2		

Table 7-4 (Cont'd). Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies of 5 KHz and below; ref. Figure 7-6.)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R57	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	1		
R58	RESISTOR, Frequency Variable	999-01-00002	06141	8830	1		
R59	RESISTOR, 402 Ohms ±1%, 1/8W	605-09-40209	06141	625	1		
R60	RESISTOR, 1.3K ±1%, 1/10W	608-09-13000	06141	624	1		
R61	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	1		
R62 & R63	(Same as R53)						
R64	RESISTOR, Frequency Variable	999-01-00001	06141	8830	1		
R65 & R66	(Same as R45)						
R67	(Same as R47)						
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
Z1 thru Z6	INTEGRATED CIRCUIT, Follower, NPN	046-89-00009	06141	12181	6	1	
Z7	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	1		

Table 7-5. Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies above 5 KHz; Ref. Figure 7-7)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	CHANNEL SELECTOR, Printed-Wiring Assy.	205-89-00207	06141	11432 (Rev. N)	1		
C1 & C2	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	4		
C3	CAPACITOR, Frequency Variable	999-01-00001	06141	8832	1		
C4	CAPACITOR, Frequency Variable	999-01-00002	06141	8832	1		
C5	CAPACITOR, Frequency Variable	999-01-00003	06141	8832	1		
C6	CAPACITOR, .1 Mf −20 or +100%, 30V	387-01-10002	25244	DA-104	8	1	
C7	CAPACITOR, 47 Pf ±2%, 500V	304-12-04709	06141	600	1		
C8	CAPACITOR, Test Variable	000-00-00000			1		
C9	CAPACITOR, Frequency Variable	999-01-00004	06141	8832	1		
C10 & C11	(Same as C6)						
C12	CAPACITOR, Frequency Variable	999-01-00005	06141	8832	1		
C13 & C14	(Same as C6)						
C15	CAPACITOR, Frequency Variable	999-01-00006	06141	8832	1		
C16	(Same as C6)						
C29	CAPACITOR, Frequency Variable	999-01-00007	06141	8830	1		
C30 & C31	CAPACITOR, Frequency Variable	999-01-00006	06141	8830	2		
C32	CAPACITOR, 30 Pf ±.5 Pf, 500V	304-08-03009	06141	600	1		
C33 & C34	(Same as C6)						
C35	CAPACITOR, 2.2 Mf ±20%, 20V	336-22-22003	06141	601	1	1	
C36 & C37	CAPACITOR, Frequency Variable	999-01-00016	06141	8830	2		
C38	CAPACITOR, 47 Pf ±.5 Pf, 500V	304-08-04709	06141	600	2		
C39	CAPACITOR, Frequency Variable	999-01-00017	06141	8830	2		
C40	(Same as C1)						
C41	CAPACITOR, Frequency Variable (Aged)	999-01-00004	06141	8830	2		
C42	CAPACITOR, 1000 Pf ±2%, 100V	304-61-10000	06141	600	1		
C43	(Same as C41)						
C44	(Same as C38)						
C45	(Same as C39)						
C46	(Same as C1)						
C47	CAPACITOR, Frequency Variable	999-01-00003	06141	8830	1		
CR1	DIODE, 9.1V, 400 MW	088-99-00379	06141	642-11	1	1	
CR2	DIODE, Frequency Variable	999-01-00018	06141	8830	3		

Table 7-5 (Cont'd.). Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies above 5 KHz; Ref. Figure 7-7.)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
CR3	DIODE, Ref., 9V/7.5 Ma, .005%	088-10-09360	04713	1N936	2		
CR4	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	2		
CR5 & CR6	(Same as CR2)						
CR7	(Same as CR4)						
CR8	(Same as CR3)						
CR9 thru CR12	DIODE	088-19-00029	08806	MPD400 4704	4		
L1	INDUCTOR, Frequency Variable	999-01-00016	06141	8832	1		
L2	INDUCTOR, Frequency Variable	999-01-00017	06141	8832	1		
L3	INDUCTOR, Frequency Variable	999-01-00018	06141	8832	1		
L4	INDUCTOR, Frequency Variable	999-01-00019	06141	8832	1		
L5	INDUCTOR, Frequency Variable	999-01-00020	06141	8832	1		
L6	INDUCTOR, Frequency Variable	999-01-00021	06141	8832	1		
Q1 & Q2	TRANSISTOR	263-10-39470	JEDEC	2N3947	1		
Q3 thru Q7	TRANSISTOR (Aged)	263-10-25010	JEDEC	2N2501	5	1	
Q8	TRANSISTOR, Frequency Variable	999-01-00019	06141	8830	1		
Q9 & Q10	TRANSISTOR	263-10-41210	JEDEC	2N4121	2	1	
Q11 & Q12	TRANSISTOR	263-10-36460	JEDEC	2N3646	2	1	
R1	RESISTOR, 56 Ohms ±5%, 1/4W	616-02-05609	01121	RC07GF560J	1		
R2	RESISTOR, Frequency Variable	999-01-00007	06141	8832	1		
R3	RESISTOR, Frequency Variable	999-01-00008	06141	8832	1		
R4	RESISTOR, Frequency Variable	999-01-00009	06141	8832	1		
R5	RESISTOR, Frequency Variable	999-01-00010	06141	8832	1		
R6	RESISTOR, Frequency Variable	999-01-00011	06141	8832	1		
R7	RESISTOR, Frequency Variable	999-01-00012	06141	8832	1		
R8	RESISTOR, Frequency Variable	999-01-00013	06141	8832	1		
R9	RESISTOR, Frequency Variable	999-01-00014	06141	8832	1		
R10	RESISTOR, 15 Ohms ±5%, 1/4W	616-02-01509	01121	RC07GF150J	1		
R11	RESISTOR, Test Variable	605-09-00000	06141	625	1		
R12	RESISTOR, 5.6K ±5%, 1/4W	616-02-56000	01121	RC07GF562J	1		
R13	RESISTOR, Frequency Variable	999-01-00015	06141	8832	1		
R19	RESISTOR, Frequency Variable	999-01-00012	06141	8830	1		

Table 7-5 (Cont'd). Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies above 5 KHz; Ref. Figure 7-7)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R32	RESISTOR, Frequency Variable	999-01-00008	06141	8830	1		
R33	RESISTOR, Frequency Variable	999-01-00009	06141	8830	1		
R33A	RESISTOR, Test Variable	000-00-00000			2		
R34	RESISTOR, 2.67K ±1%, 1/10W	608-09-26700	06141	624	1		
R34A	(Same as R33A)	000-00-00000					
R35	RESISTOR, Frequency Variable	999-01-00010	06141	8830	1		
R36	RESISTOR, 2.32K ±1%, 1/10W	608-09-23200	06141	624	2		
R39	RESISTOR, 2.2K ±5%, 1/4W	616-02-22000	01121	RC07GF222J	1		
R40 & R41	POTENTIOMETER, 10K ±10%, 1/2W	201-98-00113	80294	3255W-1-103 or 3257W	2	1	
R44	(Same as R36)						
R45 & R46	RESISTOR, Frequency Variable	999-01-00020	06141	8830	4		
R47	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	1		
R48	RESISTOR, Frequency Variable (Aged)	999-01-00013	06141	8830	2		
R49, R50, and R51	RESISTOR, 750 Ohms ±1%, 1/10W	608-09-75009	06141	624	3		
R52	(Same as R48)						
R53 & R54	RESISTOR, Frequency Variable	999-01-00015	06141	8830	4		
R55 & R56	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	2		
R57	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	1		
R58	RESISTOR, Frequency Variable	999-01-00002	06141	8830	1		
R59	RESISTOR, 402 Ohms ±1%, 1/8W	605-09-40209	06141	625	1		
R60	RESISTOR, 1.3K ±1%, 1/10W	608-09-13000	06141	624	1		
R61	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	1		
R62 & R63	(Same as R53)						
R64	RESISTOR, Frequency Variable	999-01-00001	06141	8830	1		
R65 & R66	(Same as R45)						
R67	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	1		
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
Z1	INTEGRATED CIRCUIT, Follower, PNP	046-89-00010	06141	12182	3	1	
Z2	INTEGRATED CIRCUIT, Follower, NPN	046-89-00009	06141	12181	3	1	
Z3	(Same as Z1)						

Table 7-5 (Cont'd). Model 4131-01 Channel Selector Printed-Circuit Card Parts List
(Used for center frequencies above 5 KHz; Ref. Figure 7-7)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
Z4	(Same as Z2)						
Z5	(Same as Z1)						
Z6	(Same as Z2)						
Z7	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	1		

7.3 MODELS 4131-02 AND 4131-03 CHANNEL SELECTORS

7.3.1 General

These channel selectors contain a bandpass input filter, tape-speed compensation capability, and pulse-averaging type of FM detector. The two units differ in the type of bandpass input filter provided and the center frequency deviations available. Both units are available for operation at any single subcarrier frequency from 300 Hz through 2 MHz. The Model 4131-02 will operate at any single deviation from ±2.5% through ±30%; the Model 4131-03 is available with any single deviation from ±2.5% through ±45%. The center frequency and deviation parameters of the unit are identified on the front panel.

7.3.2 Electrical Description

The electrical configuration of the channel selectors is the same as the Model 4131-01, shown in the detailed block diagram, Figure 7-2. A description of the individual circuit areas is contained in the following paragraphs with reference to Figure 7-2.

7.3.2.1 Bandpass Input Filter (BPIF)

The BPIF is tuned to extract a single subcarrier channel from an FM multiplex of subcarrier channels. This is the particular circuit area in which the Models 4131-02 and 4131-03 differ. A brief description of each BPIF is as follows:

a. Model 4131-02 BPIF -- Contains a four-pole linear-phase bandpass filter. The filter may have any of 3 separate types of synthesis which are:(1) active RC filter (2) stagger-tuned passive filter, or (3) passive ladder type. The type of filter used is dependent upon center frequency and deviation parameters. Deviation limitations are ±2.5% through ±30%. The filters are individual assemblies mounted on the channel selector printed-circuit card.

b. Model 4131-03 BPIF -- Contains a two-pole linear-phase active RC filter or passive ladder filter. The type of filter used is dependent upon the center frequency and deviation parameters. Deviations from ±2.5% through ±45% are available. The filters are individual assemblies mounted on the channel selector printed-circuit card.

7.3.2.2 Tape-Speed Compensation (TSC) and Temperature Compensation (TC) Circuit

These circuits are identical to that described in paragraph 7.2.2.2.

7.3.2.3 FM Detector

This circuit is identical to that described in paragraph 7.2.2.3.

7.3.2.4 Voltage Switch

This circuit is identical to that described in paragraph 7.2.2.4.

7.3.2.5 Deviation Sensitivity Components

These components are identical to that described in paragraph 7.2.2.5.

7.3.3 Maintenance

Maintenance to the Models 4131-02 and 4131-03 is identical to that described in paragraph 7.2.3 except that the schematic and assembly diagrams for these units are shown in Figures 7-8 and 7-9.

7.3.4 Repairs

Repairs to the Models 4131-02 and 4131-03 are identical to that described in paragraph 7.2.4 except for the parts list reference. Parts information for these units is contained in paragraph 7.3.5.

7.3.5 Parts List

Parts list for the Models 4131-02 and 4131-03 is contained in Table 7-6. Information describing the parts list breakdown, parts provisioning, and ordering information is contained in Section 6 of this manual.

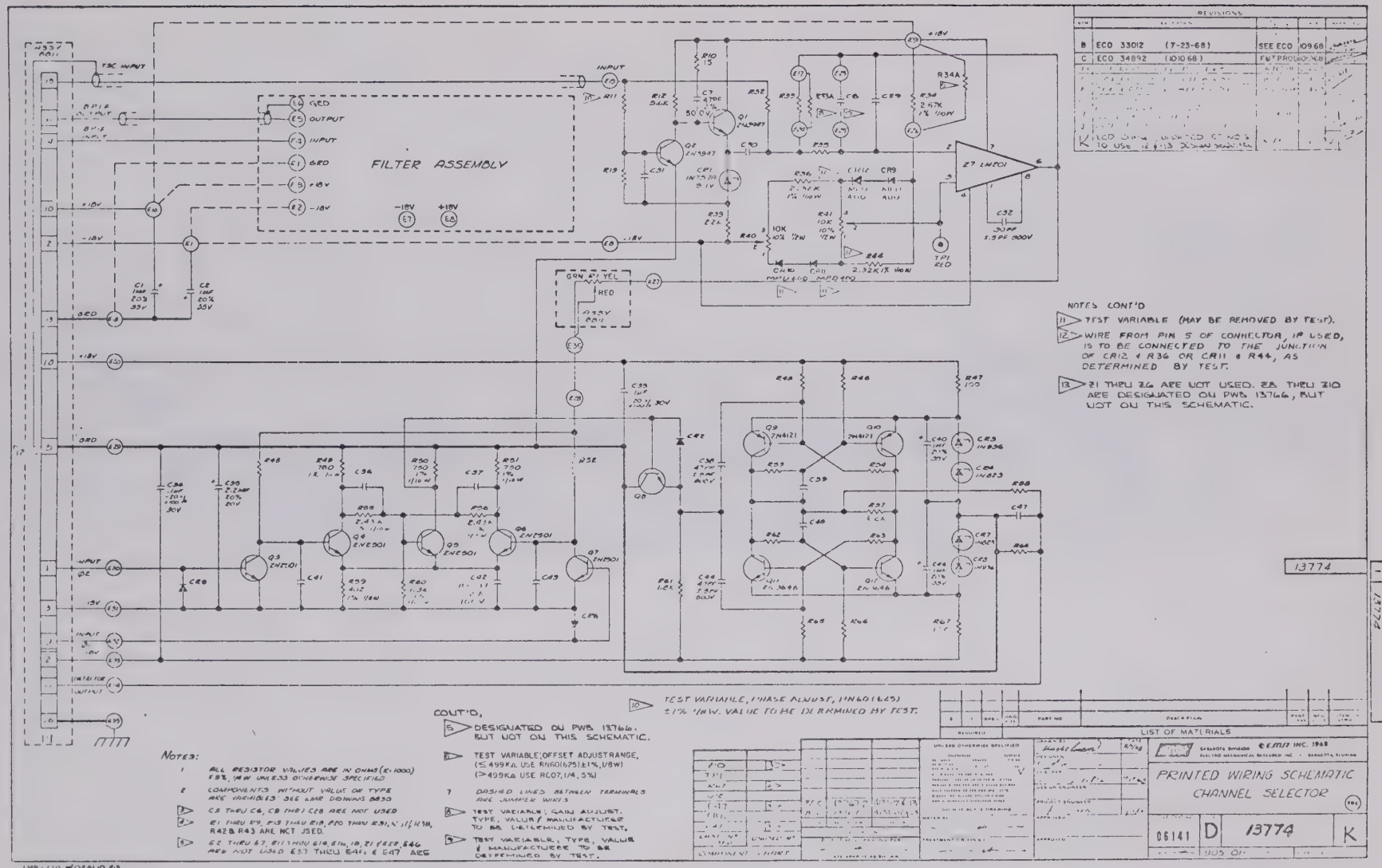
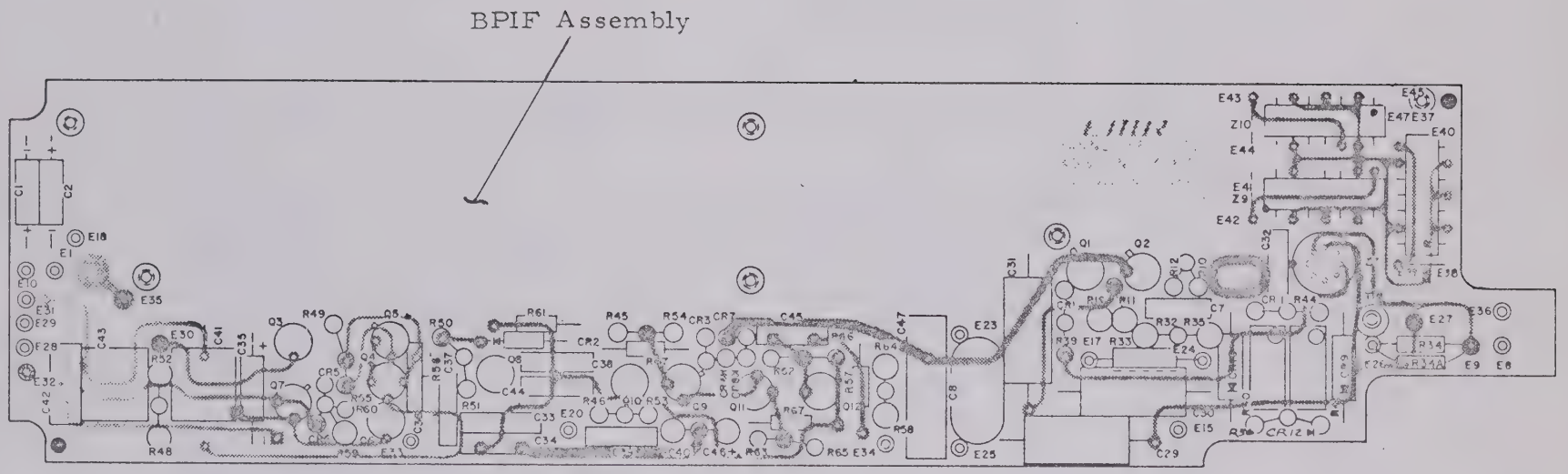


Figure 7-8. Models 4131-02 and 4131-03 Channel Selectors Printed-Circuit Card Assembly



EMR Drawing No. 13767, Rev. G

Figure 7-9. Models 4131-02 and 4131-03 Channel Selectors Printed-Circuit Card Assembly

Table 7-6. Models 4131-02 and 4131-03 Channel Selector Parts List
(Ref. Figures 7-1 and 7-8)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131-02 CHANNEL SELECTOR	414-89-00017	06141	8811-1 (Rev.C)	1		
	MODEL 4131-03 CHANNEL SELECTOR	414-89-00031	06141	8811-2(Rev.C)	1		
P1	REAR CONNECTOR	063-98-00048	02660	26-4200-16S	1		
R1	FRONT PANEL POTENTIOMETER, 1K ±10%, 1W (For frequencies below 100 KHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER, 500 Ohms ±10%, 1W (For frequencies of 100 KHz & above)	201-98-00142	02660	2901-L-501M	1	1	
	PRINTED-CIRCUIT CARD	205-89-00327	06141	13767(Rev. L)	1		
C1 & C2	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	4		
C7	CAPACITOR, 47 Pf ±2%, 500V	304-12-04709	06141	600	1		
C8	CAPACITOR, Test Variable	000-00-00000			1		
C29	CAPACITOR, Frequency Variable	999-01-00007	06141	8830	1		
C30 & C31	CAPACITOR, Frequency Variable	999-01-00006	06141	8830	2		
C32	CAPACITOR, 30 Pf ±.5 Pf, 500V	304-08-03009	06141	600	1		
C33 & C34	CAPACITOR, .1 Mf -20 or +100%, 30V	387-01-10002	25244	DA-104	2	1	
C35	CAPACITOR, 2.2 Mf ±20%, 20V	336-22-22003	06141	601	1	1	
C36 & C37	CAPACITOR, Frequency Variable	999-01-00016	06141	8830	2		
C38	CAPACITOR, 47 Pf ±.5 Pf, 500V	304-08-04709	06141	600	2		
C39	CAPACITOR, Frequency Variable	999-01-00017	06141	8830	2		
C40	(Same as C1)						
C41	CAPACITOR, Frequency Variable (Aged)	999-01-00004	06141	8830, 4704	2		
C42	CAPACITOR, 1000 Pf ±2%, 100V	304-61-10000	06141	600	1		
C43	(Same as C41)						
C44	(Same as C38)						
C45	(Same as C39)						
C46	(Same as C1)						
C47	CAPACITOR, Frequency Variable	999-01-00003	06141	8830	1		
CR1	DIODE, 9.1V, 400 Mw	088-99-00379	06141	642-11	1	1	
CR2	DIODE, Frequency Variable	999-01-00018	06141	8830	3		
CR3	DIODE, Ref., 9V/7.5 Ma	088-10-09360	04713	1N936	2		
CR4	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	2		
CR5 & CR6	(Same as CR2)						
CR7	(Same as CR4)						

Table 7-6 (Cont'd). Models 4131-02 and 4131-03 Channel Selector Parts List
(Ref. Figures 7-1 and 7-8)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
CR8	(Same as CR3)						
CR9 thru CR12	DIODE	088-19-00029	08806	MPD400	4		
Q1 & Q2	TRANSISTOR	263-10-39470	JEDEC	2N3947	2		
Q3 thru Q7	TRANSISTOR (Aged)	263-99-00099	06141	801	5	1	
Q8	TRANSISTOR, Frequency Variable	999-01-00019	06141	8830	1		
Q9 & Q10	TRANSISTOR	263-10-41210	JEDEC	2N4121	2	1	
Q11 & Q12	TRANSISTOR	263-10-36460	JEDEC	2N3646	2	1	
R10	RESISTOR, 15 Ohms ±5%, 1/4W	616-02-01509	01121	RC07GF150J	1		
R11	RESISTOR, Test Variable	605-09-00000	06141		1		
R12	RESISTOR, 5.6K ±5%, 1/4W	616-02-56000	01121	RC07GF562J	1		
R19	RESISTOR, Frequency Variable	999-01-00012	06141	8830	1		
R32	RESISTOR, Frequency Variable	999-01-00008	06141	8830	1		
R33	RESISTOR, Frequency Variable	999-01-00009	06141	8830	1		
R33A	RESISTOR, Test Variable	000-00-00000			2		
R34	RESISTOR, 2.67K ±1%, 1/10W	608-09-26700	06141	624	1		
R34A	(Same as R33A)						
R35	RESISTOR, Frequency Variable	999-01-00010	06141	8830	1		
R36	RESISTOR, 2.32K ±1%, 1/10W	608-09-23200	06141	624	2		
R39	RESISTOR, 2.2K ±5%, 1/4W	616-02-22000	01121	RC07GF222J	1		
R40 & R41	POTENTIOMETER, 10K ±10%, 1/2W	201-98-00113	80294	3255W-1-103 or 3257W	2	1	
R44	(Same as R36)						
R45 & R46	RESISTOR, Frequency Variable	999-01-00014	06141	8830	4		
R47	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	2		
R48	RESISTOR, Frequency Variable (Aged)	999-01-00013	06141	624, 4704	2		
R49 thru R51	RESISTOR, 750 Ohms ±1%, 1/10W	608-09-75009	06141	624	3		
R52	(Same as R48)						
R53 & R54	RESISTOR, Frequency Variable	999-01-00015	06141	8830	4		
R55 & R56	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	2		

Table 7-6 (Cont'd). Models 4131-02 and 4131-03 Channel Selector Parts List
(Ref. Figures 7-1 and 7-8)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R57	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	1		
R58	RESISTOR, Frequency Variable	999-01-00002	06141	8830	1		
R59	RESISTOR, 402 Ohms ±1%, 1/8W	605-09-40209	06141	625	1		
R60	RESISTOR, 1.3K ±1%, 1/10W	608-09-13000	06141	624	1		
R61	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	1		
R62 & R63	(Same as R53)						
R64	RESISTOR, Frequency Variable	999-01-00001	06141	8830	1		
R65 & R66	(Same as R45)						
R67	(Same as R47)						
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
Z7	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	1		
	BANDPASS INPUT FILTER ASSEMBLY, Frequency Variable	999-01-00002	06141	14746	1		

7.4 MODEL 4131-04 CHANNEL SELECTOR

7.4.1 General

This channel selector is a single-channel input unit which contains tape-speed compensation capability and a pulse-averaging FM detector. The unit is adjusted to operate at any single input center freqency between 300 Hz and 2 MHz and any single deviation from ±2.5% through ±45%. These parameters are identified on the front panel of the unit.

7.4.2 Electrical Description

The electrical configuration of this channel selector is similar to the circuits shown in Figure 7-2. A description of the individual circuit areas is contained in the following paragraphs with reference to Figure 7-2.

7.4.2.1 Bandpass Input Filter (BPIF)

This unit does not contain a BPIF.

7.4.2.2 Tape Speed Compensation (TSC) and Temperature Compensation (TC) Circuit

This circuit is identical to that described in paragraph 7.2.2.2 except that the delay network is removed because the TSC input does not require any delay.

7.4.2.3 FM Detector

This circuit is identical to that described in paragraph 7.2.2.3.

7.4.2.4 Voltage Switch

This circuit is identical to that described in paragraph 7.2.2.4.

7.4.2.5 Deviation Sensitivity Components

These components are identical to that described in paragraph 7.2.2.5.

7.4.3 Maintenance

Maintenance to the Model 4131-04 is identical to that described in paragraph 7.2.3 except that the unit does not contain a BPIF and TSC delay network. The schematic and assembly diagrams for this unit are shown in Figures 7-10 and 7-9. However, some components shown in Figure 7-9 are not contained on the printed-circuit card for the Model 4131-04. To identify these components refer to the schematic diagram, Figure 7-10, and parts list, paragraph 7.4.5.

7.4.4 Repairs

Repairs to the Model 4131-04 are identical to that described in paragraph 7.2.4 except for the reference to a BPIF and TSC delay circuit.

7.4.5 Parts List

Parts information for the Model 4131-04 is contained in Table 7-7. Information describing the parts list breakdown, parts provisioning, and ordering information is contained in Section 6 of this manual.

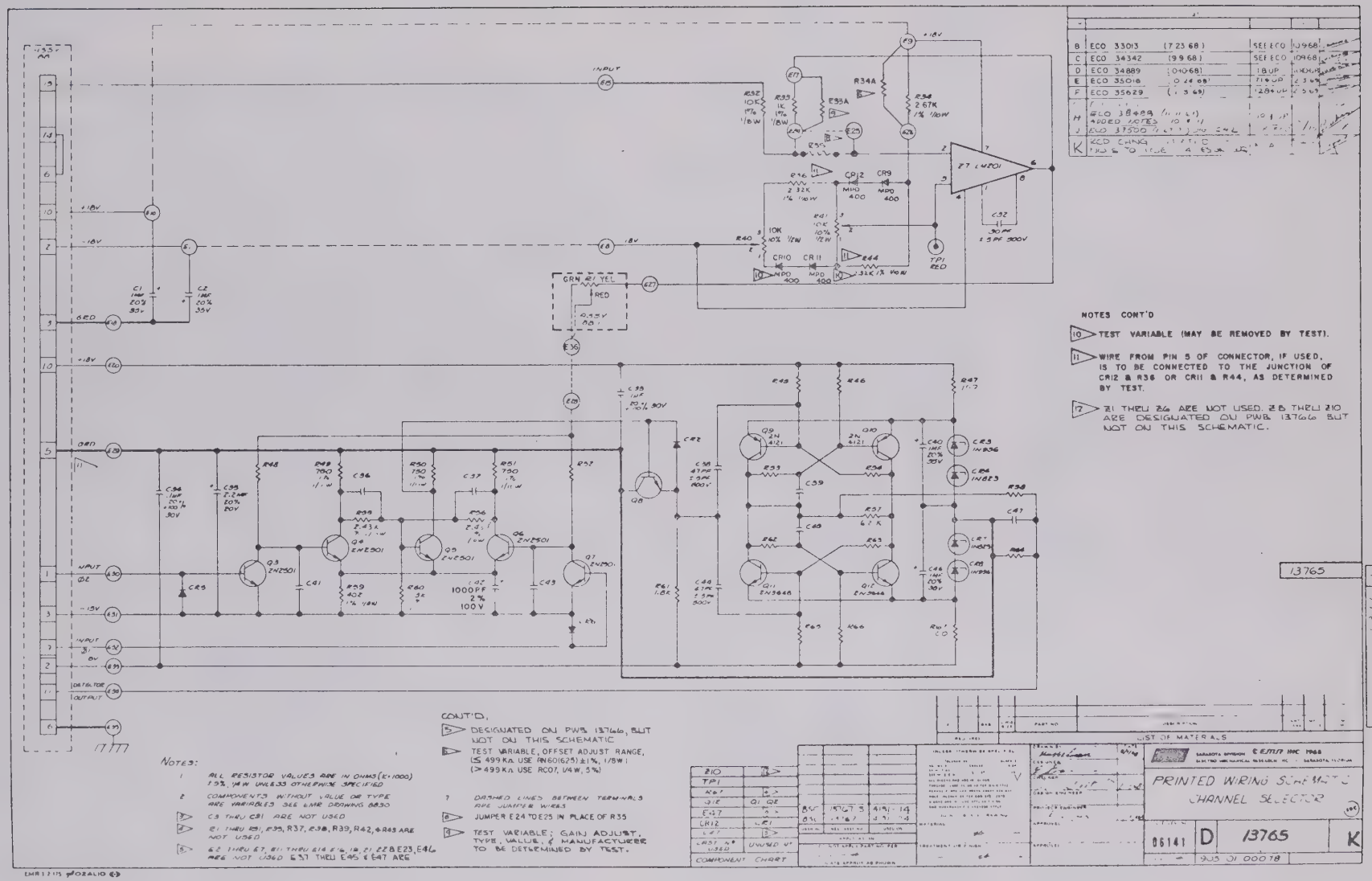


Figure 7-10. Model 4131-04 Channel Selector Schematic Diagram

Table 7-7. Model 4131-04 Channel Selector Parts List (Ref. Figures 7-1 and 7-9)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131-04 CHANNEL SELECTOR	414-89-00035	06141	8811-3 (Rev. B)	1		
P1	REAR CONNECTOR	063-98-00048	02660	26-4200-16S	1		
R1	FRONT PANEL POTENTIOMETER,1K ±10%, 1W (For frequencies below 100 KHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER,500 Ohms ±10%,1W(For frequencies of 100 KHz & above	201-98-00142	02660	2901-L-501M	1	1	
	PRINTED-CIRCUIT CARD	205-89-00360	06141	13767-1(Rev.K)	1		
C1 & C2	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	4		
C32	CAPACITOR, 30 Pf ±.5 Pf, 500V	304-08-03009	06141	600	1		
C33 & C34	CAPACITOR, .1 Mf −20 or +100%, 30V	387-01-10002	25244	DA-104	2	1	
C35	CAPACITOR, 2.2 Mf ±20%, 20V	336-22-22003	06141	601	1	1	
C36 & C37	CAPACITOR, 33 Pf ±.5 Pf, 500V	304-08-03309	06141	600	2		
C38	CAPACITOR, 47 Pf ±.5 Pf, 500V	304-08-04709	06141	600	2		
C39	CAPACITOR, 22 Pf ±.5 Pf, 500V	304-01-02209	06141	600	2		
C40	(Same as C1)						
C41	CAPACITOR, Frequency Variable (Aged)	999-01-00004	06141	8830	2		
C42	CAPACITOR, 1000 Pf ±2%, 100V	304-61-10000	06141	600	1		
C43	(Same as C41)						
C44	(Same as C38)						
C45	(Same as C39)						
C46	(Same as C1)						
C47	CAPACITOR, Frequency Variable	999-01-00003	06141	8830	1		
CR2	DIODE	088-99-00089	06141	814	3	1	
CR3	DIODE, Ref., 9V/7.5 Ma	088-10-09360	04713	1N936	2		
CR4	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	2		
CR5 & CR6	(Same as CR2)						
CR7	(Same as CR4)						
CR8	(Same as CR3)						
CR9 thru CR12	DIODE	088-19-00029	08806	MPD400	4		
Q3 thru Q7	TRANSISTOR (Aged)	263-99-00099	06141	801	5	1	

Table 7-7 (Cont'd). Model 4131-04 Channel Selector Parts List (Ref. Figures 7-1 and 7-9)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
Q8	TRANSISTOR	263-10-39470	JEDEC	2N3947	1		
Q9 & Q10	TRANSISTOR	263-10-41210	JEDEC	2N4121	2	1	
Q11	TRANSISTOR	263-10-36460	JEDEC	2N3646	2	1	
Q12	(Same as Q11)						
R32	RESISTOR, Frequency Variable	999-01-00008	06141	8830	1		
R33	RESISTOR, Frequency Variable	999-01-00009	06141	8830	1		
R33A	RESISTOR, Test Variable	000-00-00000			2		
R34	RESISTOR, 2.67K ±1%, 1/10W	608-09-26700	06141	624	1		
R34A	(Same as R33A)						
R36	RESISTOR, 2.32K ±1%, 1/10W	608-09-23200	06141	624	2		
R40 & R41	POTENTIOMETER, 10K ±10%, 1/2W	201-98-00113	80294	3255W-1-103 or 3257W	2	1	
R44	(Same as R36)						
R45 & R46	RESISTOR, 3.6K ±5%, 1/4W	616-02-36000	01121	RC07GF362J	4		
R47	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	2		
R48	RESISTOR, Frequency Variable (Aged)	999-01-00013	06141	8830	2		
R49 thru R51	RESISTOR, 750 Ohms ±1%, 1/10W	608-09-75009	06141	624	3		
R52	(Same as R48)						
R53 & R54	RESISTOR, 13K ±5%, 1/4W	616-02-13001	01121	RC07GF133J	2		
R55 & R56	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	2		
R57	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	1		
R58	RESISTOR, Frequency Variable	999-01-00002	06141	8830	1		
R59	RESISTOR, 402 Ohms ±1%, 1/8W	605-09-40209	06141	625	1		
R60	RESISTOR, 1.3K ±1%, 1/10W	608-09-13000	06141	624	1		
R61	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	1		
R62 & R63	RESISTOR, 13K ±5%, 1/4W	616-02-13001	01121	RC07GF133J	2		
R64	RESISTOR, Frequency Variable	999-01-00001	06141	8830	1		
R65 & R66	(Same as R45)						
R67	(Same as R47)						

Table 7-7 (Cont'd). Model 4131-04 Channel Selector Parts List (Ref. Figures 7-1 and 7-9)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
Z7	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	1		

7.5 MODELS 4131-51 AND 4131-52 REFERENCE CHANNEL SELECTORS

7.5.1 General

These channel selectors are used in conjunction with a Model 4130 Basic Unit to form a reference discriminator. The 4131-51 and -52 are identical except for the built-in multiplex delay line facility. Included in the Model 4131-51 is a delay line which matches the delay through the reference channel selector.

7.5.2 Specifications

Specifications for the reference discriminator are the same as listed for the data discriminator in Section 2 with a few exceptions. These exceptions are as listed below:

a. Center Frequencies: 17, 25, 50, 100, and 240 KHz are standard. Other frequencies are available on special request.

b. Deviation: ±7.5%

7.5.3 Operation

Operation of the reference discriminator is similar to the operation of a data discriminator as outlined in Section 3 of this manual. The difference is the inclusion of a front panel OFF/ON switch on the reference channel selector. A front panel view of the reference channel selector is shown in Figure 7-11.

Another consideration in the reference discriminator operation is the deviation polarity of the TSC output to the data discriminators. When using EMR 4130 Data Discriminators, the OFF/POS/NEG switch on the basic unit of the reference discriminator is to be positioned to NEG.

7.5.4 Electrical Description

The reference channel selectors detailed block diagram is shown in Figure 7-12. As shown on this diagram, certain circuit areas are identical to corresponding circuits in the data discriminators. Circuit descriptions for these common circuits are referenced to other paragraphs of this section.

Electrically, the Models 4131-51 and 4131-52 are identical except for the multiplex delay line. Only the 4131-51 contains an internal delay line. When using the 4131-52, an external delay line must be used to match the total delay through the reference discriminator.

7.5.4.1 Bandpass Input Filter (BPIF)

The BPIF is tuned to extract the reference frequency from an FM multiplex of subcarrier channels. All other channels in the multiplex are rejected. The

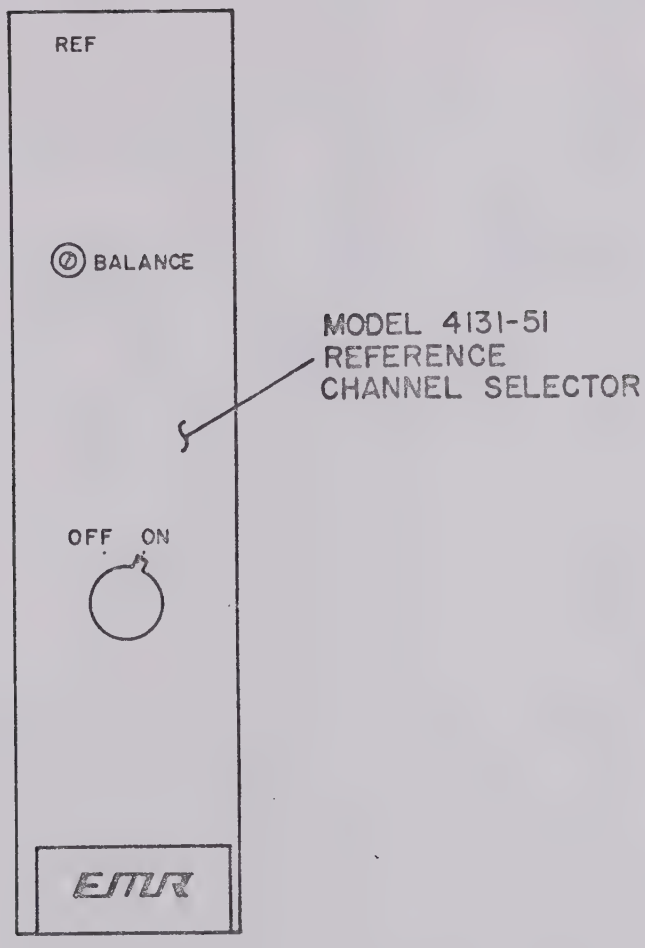


Figure 7-11. Models 4131-51 and 4131-52
Reference Channel Selectors Front Panel

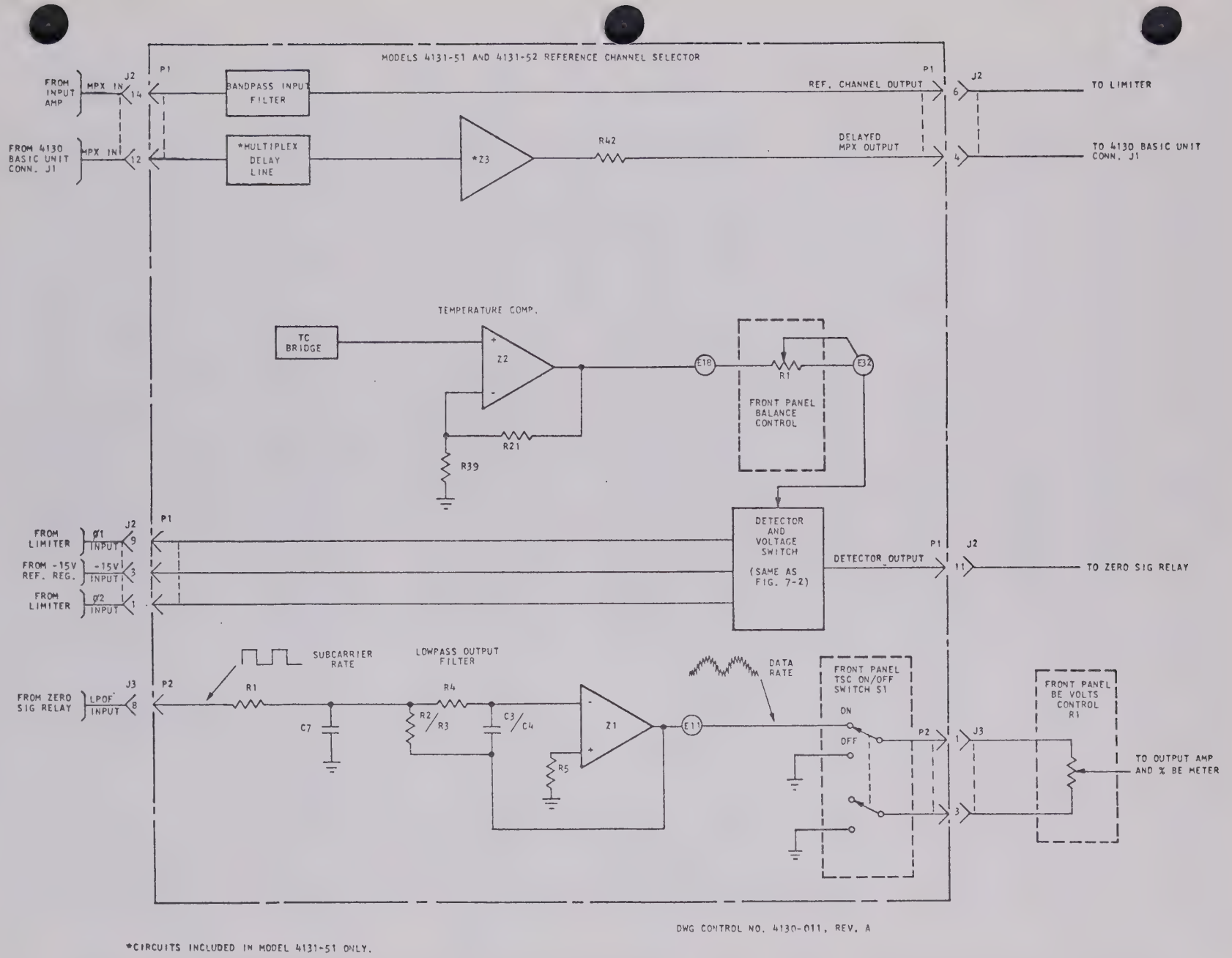


Figure 7-12. Models 4131-51 and 4131-52 Reference Channel Selectors Detailed Block Diagram

BPIF is basically a four pole-pair linear-phase passive ladder network. However, since this circuit is non-field repairable, a detailed circuit description is not included in this manual.

7.5.4.2 Temperature Compensation (TC) Circuit

This circuit is very similar to the TC circuit in other channel selectors. For a description of the TC circuit, refer to paragraph 7.2.2.2.

7.5.4.3 FM Detector

This circuit is identical to the FM detector described in paragraph 7.2.2.3.

7.5.4.4 Voltage Switch

This circuit is identical to the voltage switch described in paragraph 7.2.2.4.

7.5.4.5 Multiplex Delay Line

The multiplex delay line is designed to delay the FM multiplex an amount equal to the total delay in the reference discriminator bandpass and lowpass filters The delayed multiplex output is then routed to the associated data discriminators in the data reduction system. This delay is provided so that the TSC error output of the reference discriminator and the FM multiplex output to the data discriminators occurs at the same time. For a TSC system description, refer to Section 3 of this manual.

The multiplex delay line consists of passive components L1 through L28 and C27 through C53, and an active amplifier stage Z3. The delay characteristics are provided by the passive components which are sized to exhibit the necessary time delay for the selected reference channel. Active stage Z3 is a +1 amplifier which isolates the delay components from the external units.

7.5.4.6 Lowpass Output Filter

The LPOF is a 2-pole active RC network which attenuates the reference frequency leaving only the modulation component in the reference channel. This modulation, if any, is the error signal introduced due to wow and flutter and tape-speed variations when the FM multiplex is recorded and played back.

The LPOF network is a built-in circuit designed for the selected reference subcarrier center frequency. A certain delay is incurred in the filter process; however, the multiplex delay line is designed to match the total delay in the reference discriminator which includes the BPIF and LPOF delays. Filtering action occurs due to the decreasing impedance of the passive components as the input frequency increases. An active amplifier stage (Z1) isolates the filter components from circuits at the LPOF output.

7.5.5 Maintenance

Reference Channel Selector maintenance is divided into three categories: general inspection, troubleshooting, and repair. An inspection should be performed periodically to ensure that all mechanical components are secured and that all electrical components including internal wiring are properly installed.

NOTE

Before replacing any defective component in the reference channel selector, refer to paragraph 7.5.6, Repairs.

If a malfunction occurs, an inspection of the unit may indicate the problem. However, if an electrical failure occurs, troubleshooting the unit using the electrical description (para. 7.5.4), schematics diagrams (Figures 7-13 and 7-14), and assembly diagram (Figure 7-15) will aid in localizing the trouble. Additional aids in troubleshooting are provided in the channel selector waveforms and transistor voltage measurements, and output filter waveforms. The waveforms shown in Table 7-1 apply to the reference channel selector as well as the data channel selector. Output filter waveforms for the output filter in reference channel selector are shown in Figure 7-12. The transistor voltage measurements contained in Table 7-2 generally apply to circuits in the reference channel selector.

Certain circuits of the reference channel selector are not field repairable; therefore, detailed troubleshooting in these circuits is not recommended. The non-field repairable circuits are: (1) Bandpass Input Filter; and (2) Temperature Compensation Circuit. Additional information concerning these circuits is contained in para. 7.5.6, Repairs.

7.5.6 Repairs

Repairs to the reference channel selector may be made in the FM detector, voltage switch, lowpass output filter, and multiplex delay line (Model 4131-51 only) circuits. Components in these circuits found to be defective can be replaced without degrading unit operation. Replacement components are described in para. 7.5.7, Parts List.

NOTE

Certain components are aged at EMR to yield optimum performance. These components must be replaced with aged components per EMR specification. When replacing any aged component, order component from EMR and specify aged component. These components are identified in the parts list.

7.5.7 Parts List

The parts lists for the reference channel selector are contained in Tables 7-8, 7-9, and 7-10. Diagrams which illustrate the components listed in these tables are referenced in the table title. Information describing the parts list breakdown, parts provisioning, and ordering information is contained in Section 6 of this manual.

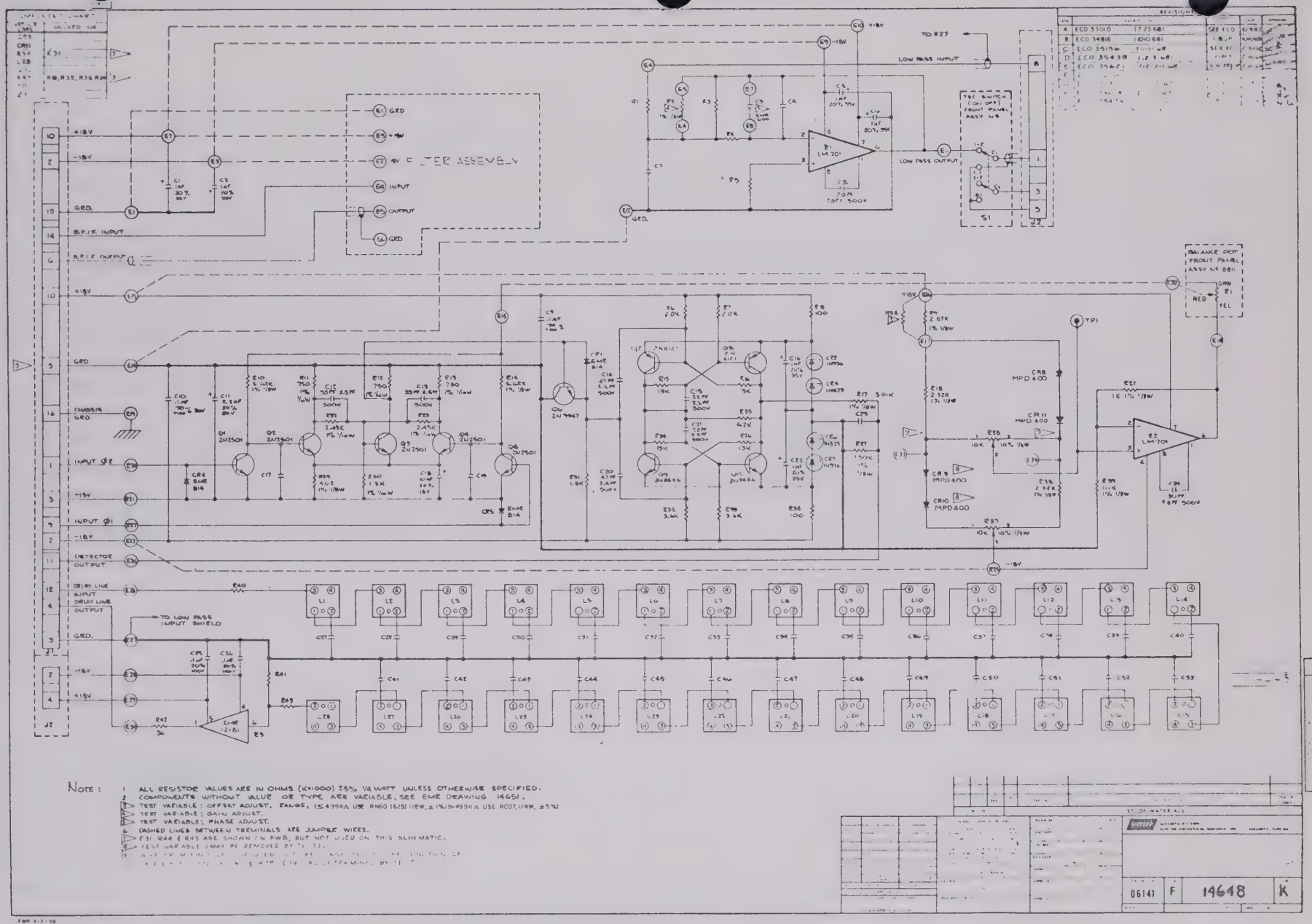
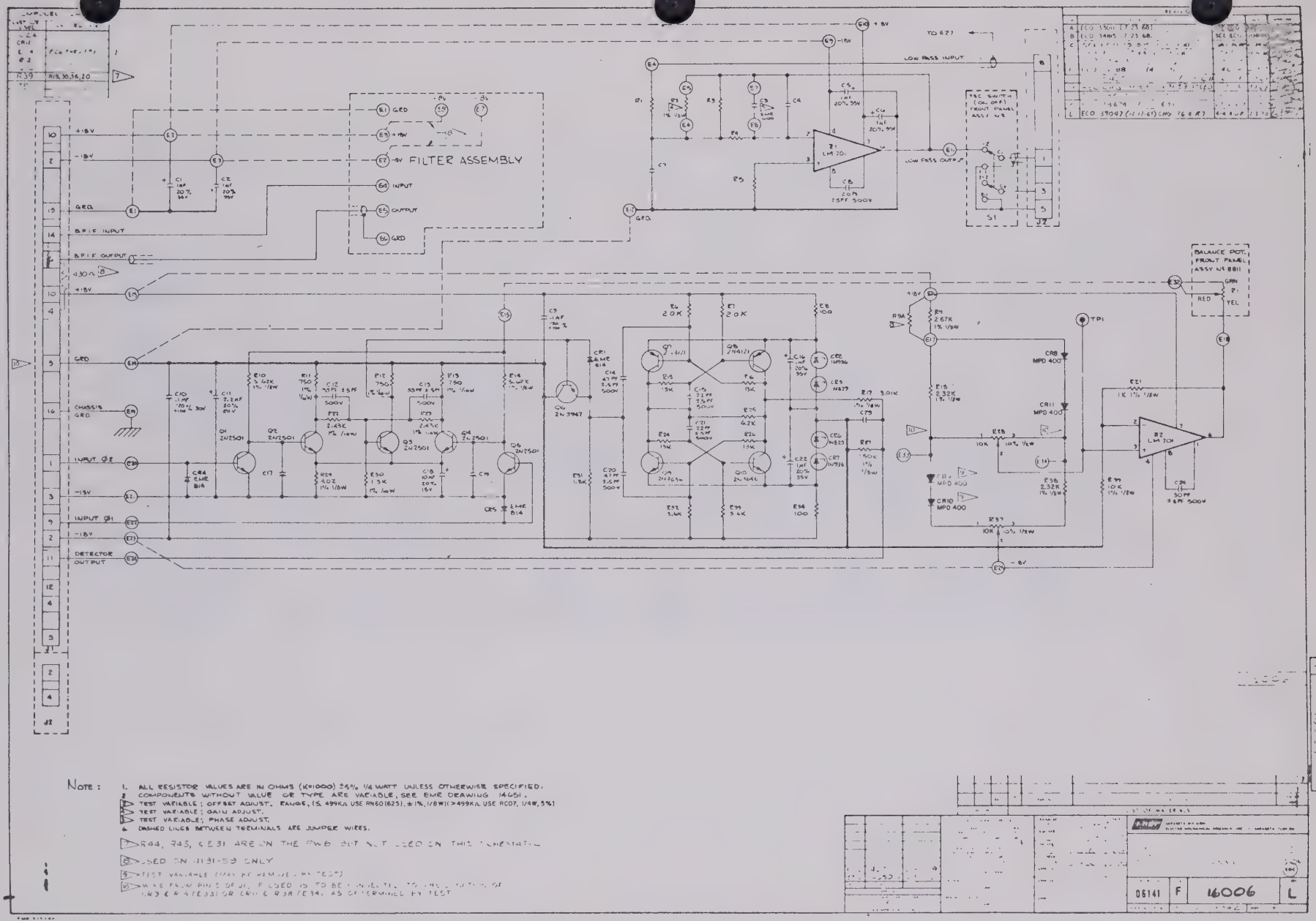


Figure 7-13. Model 4131-51 Reference Channel Selector Schematic Diagram



NOTE:

1. ALL RESISTOR VALUES ARE IN OHMS (K=1000) ±5% 1/4 WATT UNLESS OTHERWISE SPECIFIED. COMPONENTS WITHOUT VALUE OR TYPE ARE VARIABLE, SEE EMR DRAWING 14651.
2. TEST VARIABLE; OFFSET ADJUST. RANGE, (≤ 499KΩ USE RN60(625), ±1%, 1/8W)(>499KΩ USE RC07, 1/4W, 5%)
3. TEST VARIABLE; GAIN ADJUST.
4. TEST VARIABLE; PHASE ADJUST.
5. DASHED LINES BETWEEN TERMINALS ARE JUMPER WIRES.

△ R44, R45, & E31 ARE ON THE PWB BUT NOT USED ON THIS SCHEMATIC

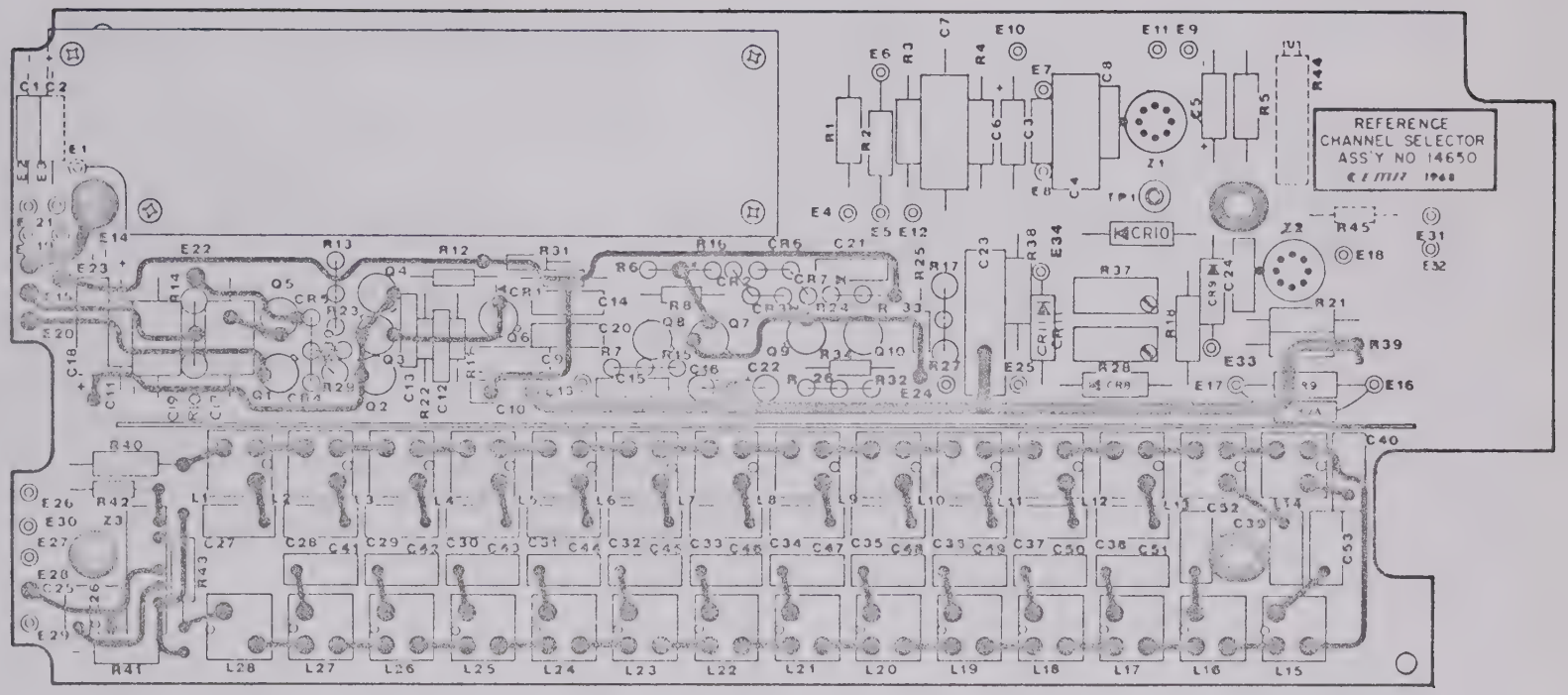
B USED ON 4131-53 ONLY

5 TEST VARIABLE (VALUE REMOVED BY TEST)

10 WIRE FROM PINS OF J1, IF USED IS TO BE INSERTED TO ONE SIDE OF R43 & R44 (E33) OR CR11 & R38 (E34) AS DETERMINED BY TEST

08141 | F | 16006 | L

Figure 7-14. Model 4131-52 Reference Channel Selector Schematic Diagram



EMR Drawing No. 14650, Rev. H

Figure 7-15. Models 4131-51 and 4131-52 Reference Channel Selectors Printed-Circuit Card Assembly Diagram

Table 7-8. Models 4131-51 and 4131-52 Reference Channel Selector Parts List (Ref. Figure 7-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131-51 REFERENCE CHANNEL SELECTOR	414-89-00038	06141	16137 (Rev. E)	1		
	MODEL 4131-52 REFERENCE CHANNEL SELECTOR	414-89-00039	06141	16137-1 (Rev. F)	1		
P1	REAR CONNECTOR	063-98-00048	02660	26-4200-16S	1		
P2	REAR CONNECTOR	063-98-00036	02660	26-4200-8S	1		
R1	FRONT PANEL POTENTIOMETER, 1K ±10%, 1W (For frequencies below 100 KHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER, 500 Ohms ±10%, 1W (For frequencies of 100 KHz and above)	201-98-00142	02660	2901-L-501M	1	1	
S1	SWITCH	250-89-00021	06141	8009-3	1		
	PRINTED-CIRCUIT CARD (Used in Model 4131-51, See Table 7-9 for breakdown)	205-89-00404	06141	14650	1		
	PRINTED-CIRCUIT CARD (Used in Model 4131-52, See Table 7-10 for breakdown)	205-89-00405	06141	14650-1	1		

Table 7-9. Model 4131-51 Reference Channel Selector
Printed-Circuit Card Parts List (Ref. Figure 7-15)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	CHANNEL SELECTOR PRINTED-CIRCUIT CARD	205-89-00404	06141	14650 (Rev.L)	1		
C1 & C2	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	6	1	
C3	CAPACITOR, Test Variable, ±1%, 500V	304-13-00000			1		
C4	CAPACITOR, Frequency Variable	999-01-00006	06141	14651	1		
C5 & C6	(Same as C1) .						
C7	CAPACITOR, Frequency Variable	999-01-00007	06141	14651	1		
C8	CAPACITOR, 20 Pf ±.5Pf, 500V	304-01-02009	06141	600	2		
C9 &C10	CAPACITOR, .1Mf −20 + 100%, 30V	387-01-10002	25244	DA-104	2	1	
C11	CAPACITOR, 2.2 Mf ±20%, 20V	336-22-22003	06141	601	1	1	
C12 & C13	CAPACITOR, 33 Pf ±.5Pf, 500V	304-08-03309	06141	600	2		
C14	CAPACITOR, 47 Pf ±.5Pf, 500V	304-08-04709	06141	600	2		
C15	CAPACITOR, 22Pf ±.5Pf, 500V	304-01-02209	06141	600	2		
C16	(Same as C1)						
C17	CAPACITOR, Frequency Variable (Aged)	999-01-00001	06141	14651	2		
C18	CAPACITOR, 10 Mf ±20%, 15V	337-21-10004	06141	601	1	1	
C19	(Same as C17)						
C20	(Same as C14)						
C21	(Same as C15)						
C22	(Same as C1)						
C23	CAPACITOR, Deviation Variable	999-01-00005			1		
C24	(Same as C8)						
C25 & C26	CAPACITOR, .1Mf ±20%, 50V	301-13-10002	72982	8131-050-651-104M	2		
C27 thru C53	CAPACITOR, Frequency Variable	999-01-00015	06141	14651	27		
CR1	DIODE, Switch, 50V	088-10-30640	JEDEC	1N3064	3	1	
CR2	DIODE, Ref., 9V/7.5 Ma	088-10-09360	04713	1N936	2		
CR3	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	2		
CR4	(Same as CR1)						
CR5	(Same as CR1)						
CR6	(Same as CR3)						

Table 7-9 (Cont'd.). Model 4131-5 Reference Channel Selector
Printed-Circuit Card Parts List (Ref. Figure 7-15)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
CR7	(Same as CR2)						
CR8 thru CR11	DIODE	088-19-00029	08806	MPD400	4		
L1	INDUCTOR, Frequency Variable	999-01-00012	06141	14651	1		
L2 thru L27	INDUCTOR, Frequency Variable	999-01-00013	06141	14651	26		
L28	INDUCTOR, Frequency Variable	999-01-00014	06141	14651	1		
Q1 thru Q5	TRANSISTOR, NPN Switch	263-99-00099	06141	801	5	1	
Q6	TRANSISTOR	263-10-39470	JEDEC	2N3947	1		
Q7 & Q8	TRANSISTOR	263-10-41210	JEDEC	2N4121	2	1	
Q9 & Q10	TRANSISTOR	263-10-36460	JEDEC	2N3646	2	1	
R1	RESISTOR, Frequency Variable	999-01-00008	06141	14651	1		
R2	RESISTOR, Test Variable, ±1%, 1/8W	605-01-00000			1		
R3	RESISTOR, Frequency Variable	999-01-00009	06141	14651	1		
R4	RESISTOR, Frequency Variable	999-01-00010	06141	14651	1		
R5	RESISTOR, Frequency Variable	999-01-00011	06141	14651	1		
R6 & R7	RESISTOR, 2K ±5%, 1/4W	616-02-20000	01121	RC07GF202J	2		
R8	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	2		
R9	RESISTOR, 2.67K ±1%, 1/8W	605-09-26700	06141	625	1		
R9A	RESISTOR, Test Variable	000-00-00000			1		
R10	RESISTOR, 5.62K ±1%, 1/8W (Aged)	605-09-56200	06141	625	2		
R11 thru R13	RESISTOR, 750 Ohms ±1%, 1/10W	608-09-75009	06141	624	3		
R14	(Same as R10)						
R15 & R16	RESISTOR, 13K ±5%, 1/4W	616-02-13001	01121	RC07GF133J	4		
R17	RESISTOR, 3.01K ±1%, 1/8W	605-09-30100	06141	625	1		
R18	RESISTOR, 2.32K ±1%, 1/8W	605-09-23200	06141	625	2		

Table 7-9 (Cont'd.). Model 4131-5 Reference Channel Selector
Printed-Circuit Card Parts List (Ref. Figure 7-15)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R21	RESISTOR, 1K ±1%, 1/8W	605-09-10000	06141	625	1		
R22 & R23	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	2		
R24	(Same as R15)						
R25	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	1		
R26	(Same as R15)						
R27	RESISTOR, 1.5K ±1%, 1/8W	605-09-15000	06141	625	1		
R28	POTENTIOMETER, 10K ±10%, 1/2W	201-98-00113	80294	3255W-1-103 or 3257W	2	1	
R29	RESISTOR, 402 Ohms ±1%, 1/8W	605-09-40209	06141	625	1		
R30	RESISTOR, 1.3K ±1%, 1/10W	608-09-13000	06141	624	1		
R31	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	1		
R32 & R33	RESISTOR, 3.6K ±5%, 1/4W	616-02-36000	01121	RC07GF362J	2		
R34	(Same as R8)						
R37	(Same as R28)						
R38	(Same as R18)						
R39	RESISTOR, 10.0K ±1%, 1/8W	605-09-10001	06141	625	1		
R40	RESISTOR, Frequency Variable	999-01-00016	06141	14651	1		
R41	RESISTOR, Frequency Variable	999-01-00017	06141	14651	1		
R42	RESISTOR, 56 Ohms ±5%, 1/4W	616-02-05609	01121	RC07GF560J	1		
R43	RESISTOR, Frequency Variable	999-01-00018	06141	14651	1		
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
Z1 & Z2	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	2		
Z3	INTEGRATED CIRCUIT, Assy, Follower, NPN	046-89-00009	06141	12181	1	1	

Table 7-10. Model 4131-52 Reference Channel Selector
Printed-Circuit Card Parts List (Ref. Figure 7-15)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	CHANNEL SELECTOR, PRINTED-CIRCUIT CARD	205-89-00405	06141	14650-1 (Rev. M)	1		
C1 & C2	CAPACITOR, 1.0Mf ±20%, 35V	336-23-10003	06141	601	6		
C3	CAPACITOR, Test Variable, ±1%, 500V	304-13-00000			1		
C4	CAPACITOR, Frequency Variable	999-01-00006	06141	14651	1		
C5 & C6	(Same as C1)						
C7	CAPACITOR, Frequency Variable	999-01-00007	06141	14651	1		
C8	CAPACITOR, 20 Pf±.5Pf, 500V	304-01-02009	06141	600	2		
C9 & C10	CAPACITOR, .1Mf −20 + 100%, 30V	387-01-10002	25244	DA-104	2	1	
C11	CAPACITOR, 2.2Mf ±20%, 20V	336-22-22003	06141	601	1		
C12 & C13	CAPACITOR, 33Pf ±.5Pf, 500V	304-08-03309	06141	600	2		
C14	CAPACITOR, 47Pf ±.5Pf, 500V	304-08-04709	06141	600	2		
C15	CAPACITOR, 22Pf ±.5Pf, 500V	304-01-02209	06141	600	2		
C16	(Same as C1)						
C17	CAPACITOR, Frequency Variable (Aged)	999-01-00001	06141	14651	2		
C18	CAPACITOR, 10 Mf ±20%, 15V	337-21-10004	06141	601	1	1	
C19	(Same as C17)						
C20	(Same as C14)						
C21	(Same as C15)						
C22	(Same as C1)						
C23	CAPACITOR, Deviation Variable	999-01-00005			1		
C24	(Same as C8)						
CR1	DIODE, Switch, 50V	088-10-30640	JEDEC	1N3064	3	1	
CR2	DIODE, Ref., 9V/7.5 Ma	088-10-09360	04713	1N936	2		
CR3	DIODE, Ref., 6.2V/7.5 Ma	088-97-08230	04713	1N823	2		
CR4	(Same as CR1)						
CR5	(Same as CR1)						
CR6	(Same as CR3)						
CR7	(Same as CR2)						
CR8 thru CR11	DIODE	088-19-00029	08806	MPD400	4		

Table 7-10 (Cont'd.). Model 41[illegible]2 Reference Channel Selector
Printed-Circuit Card Parts List (Ref. Figure 7-15)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
Q1 thru Q5	TRANSISTOR, NPN Switch	263-99-00099	06141	801	5	1	
Q6	TRANSISTOR	263-10-39470	JEDEC	2N3947	1		
Q7 & Q8	TRANSISTOR	263-10-41210	JEDEC	2N4121	2	1	
Q9 & Q10	TRANSISTOR	263-10-36460	JEDEC	2N3646	2	1	
R1	RESISTOR, Frequency Variable	999-01-00008	06141	14651	1		
R2	RESISTOR, Test Variable, ±1%, 1/8W	605-01-00000	06141	625	1		
R3	RESISTOR, Frequency Variable	999-01-00009	06141	14651	1		
R4	RESISTOR, Frequency Variable	999-01-00010	06141	14651	1		
R5	RESISTOR, Frequency Variable	999-01-00011	06141	14651	1		
R6 & R7	RESISTOR, 2K ±5%, 1/4W	616-02-20000	01121	RC07GF202J	2		
R8	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	2		
R9	RESISTOR, 2.67K ±1%, 1/8W	605-09-26700	06141	625	1		
R9A	RESISTOR, Test Variable	000-00-00000			1		
R10	RESISTOR, 5.62K ±1%, 1/8W	605-09-56200	06141	625	2		
R11 thru R13	RESISTOR, 750 Ohms ±1%, 1/10W	608-09-75009	06141	624	3		
R14	(Same as R10)						
R15 & R16	RESISTOR, 13K ±5%, 1/4W	616-02-13001	01121	RC07GF133J	4		
R17	RESISTOR, 3.01K ±1%, 1/8W	605-09-30100	06141	625	1		
R18	RESISTOR, 2.32K ±1%, 1/8W	605-09-23200	06141	625	2		
R21	RESISTOR, 1K ±1%, 1/8W	605-09-10000	06141	625	1		
R22 & R23	RESISTOR, 2.43K ±1%, 1/10W	608-09-24300	06141	624	2		
R24	(Same as R15)						
R25	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	1		
R26	(Same as R15)						
R27	RESISTOR, 1.5K ±1%, 1/8W	605-09-15000	06141	625	1		
R28	POTENTIOMETER, 10K ±10%, 1/2W	201-98-00113	80294	3255W-1-103 or 3257W	2	1	

Table 7-10 (Cont'd.). Model 41[illegible]-52 Reference Channel Selector
Printed-Circuit Card Parts List (Ref. Figure 7-15)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R29	RESISTOR, 402 Ohms ±1%, 1/8W	605-09-40209	06141	625	1		
R30	RESISTOR, 1.3K ±1%, 1/10W	608-09-13000	06141	624	1		
R31	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	1		
R32 & R33	RESISTOR, 3.6K ±5%, 1/4W	616-02-36000	01121	RC07GF362J	2		
R34	(Same as R8)						
R37	(Same as R28)						
R38	(Same as R18)						
R39	RESISTOR, 10.0K ±1%, 1/8W	605-09-10001	06141	625	1		
TP1	JACK, Test, Red	143-98-00009	74970	105-852	1		
Z1 & Z2	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	2		

7.6 MODEL 4131-59 REFERENCE CHANNEL SELECTOR

This channel selector is designed for use with a Model 4130 Basic Unit to form a reference discriminator. The combined 4130/4131-59 is intended for use as the reference discriminator for the EMR Model 4059 Group Frequency Detranslator. Matching delay and reference frequency conditioning are provided in the 4131-59 for the 4059.

The 4131-59 channel selector is identical to the 4131-52 described in paragraph 7.5 except for the following items:

a. Center Frequencies: 120, 240, 480, and 960 KHz are standard. Other frequencies are availab'e on special request.

b. Bandpass Input Filter (BPIF) Bandwidth: 5%.

c. The selected reference frequency output of the BPIF is conditioned and output from the unit. This output is available at the 4130 rear connector P1 pin 9.

d. A resistor is included in the conditioned reference frequency output line. This resistor is installed between the channel selector connector P1 pins 4 and 6. The resistor is described as follows:

RESISTOR, 430 ohms ±5%, 1/4W, EMR
STOCK NO. 616-02-43009,
MFGR. CODE 01121, MFGR.
PART NO. RC07GF431J,
and TQ1.

e. The top assembly part number for the 4131-59 is EMR 16137-4.

f. The 4131-59 printed-circuit card part number is EMR 14650-2 (revision C).

SECTION 8

EMR MODEL 4137 OUTPUT FILTERS

8.1 INTRODUCTION

The Model 4137, shown in Figure 8-1, is a low-pass output filter designed for use with an EMR Model 4131 Channel Selector and an EMR Model 4130 Basic Unit to comprise an EMR 4130 Data Discriminator. The Models 4131 and 4137 are plug-in units which mount in the Model 4130 Basic Unit establishing the data subcarrier channel parameters. When the 4130 Subcarrier Discriminator is used as a reference discriminator, the Model 4137 is not required. For the reference discriminator configuration, a Model 4131-50-Series Reference Channel Selector is installed in the Model 4130 Basic Unit and this channel selector occupies both plug-in locations. The appropriate output filter for the selected reference frequency is an integral part of the reference channel selector. For information describing the Model 4131 Channel Selector, refer to Section 7 of this manual.

The Model 4137 establishes the overall data response for the modulation component contained in the subcarrier channel. Specific parameters selected by the Model 4137 include the data cutoff frequency, the asymptotic rolloff beyond the cutoff frequency, and the response characteristic.

The standard output filters available include a Model 4137-05 and a Model 4137-06. These filters are 5-pole and 7-pole configurations with any selected cutoff frequency of 3 Hz through 450 KHz. Switchable response characteristic (CA or CD) is front-panel switch-selectable. The 5-pole filter (Model 4137-05) rolloff beyond cutoff is 30 Db/octave, while the rolloff of the 7-pole filter (Model 4137-06) is 42 Db/octave.

There are two versions of each Model 4137-05 and each Model 4137-06, one for cutoff frequencies below 1 KHz and a second for cutoff frequencies of 1 KHz through 450 KHz. Functionally, the two 4137-05 versions are identical as well as the two 4137-06 versions are identical. Detailed circuit configurations differ significantly as described in paragraph 8.2.

8.2 ELECTRICAL DESCRIPTION

8.2.1 Model 4137-05

The electrical configuration of the output filter is shown in the block diagram, Figure 8-2. The low frequency filter consists of a 3-pole network, a 2-pole network, and active amplifier circuits. Each filter network is made up of RC combinations connected in a basic low-pass configuration using RC synthesis. Active components are used to provide isolation between filter sections, and to adjust the overall voltage gain of the filter. Two amplifiers (-1 and -2) provide a voltage gain of approximately +2. Front-panel response switch S1 selects appropriate feedback components establishing the filter response type.

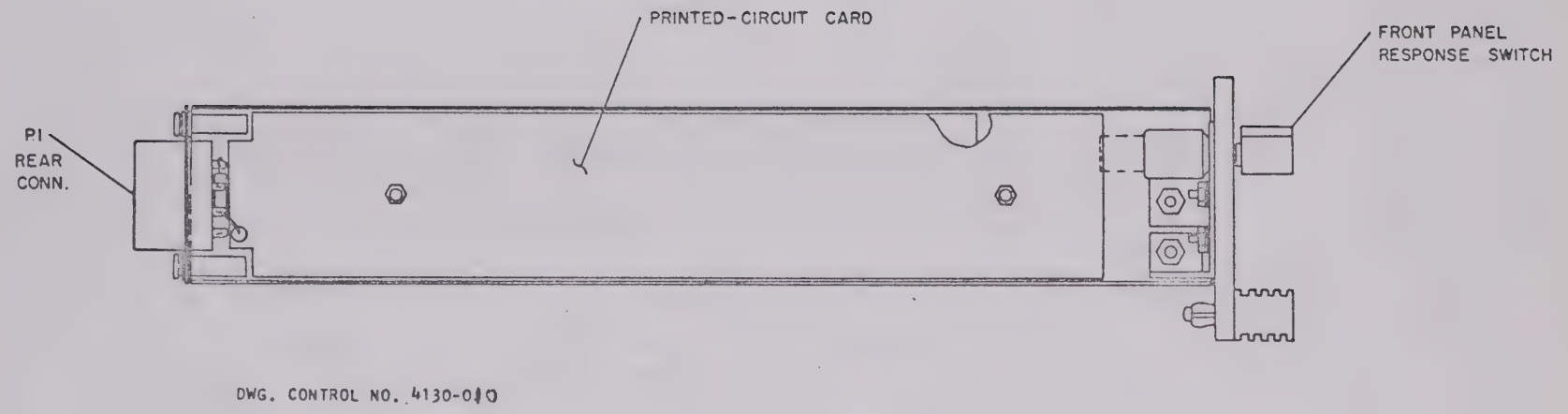
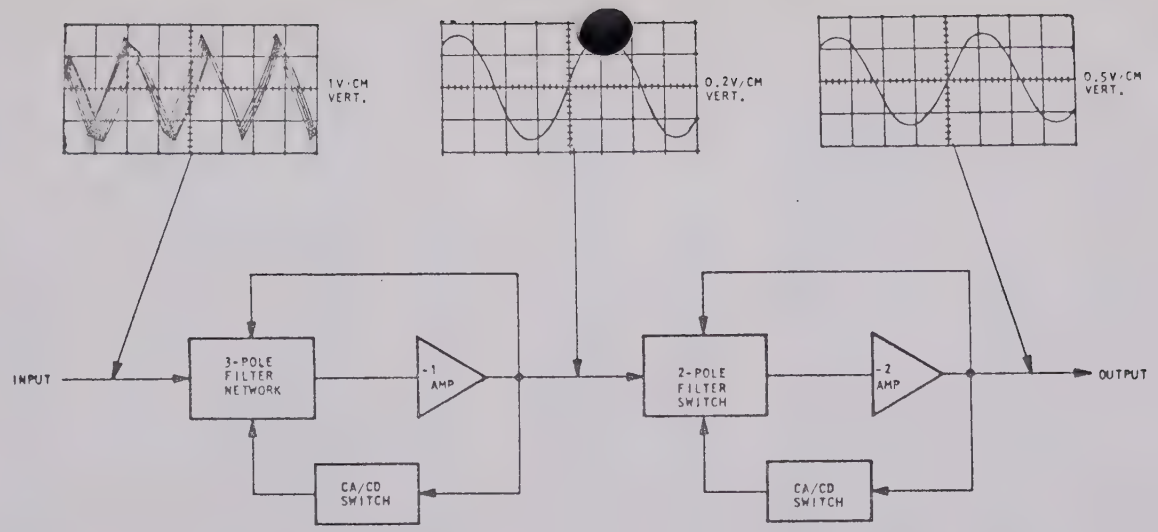
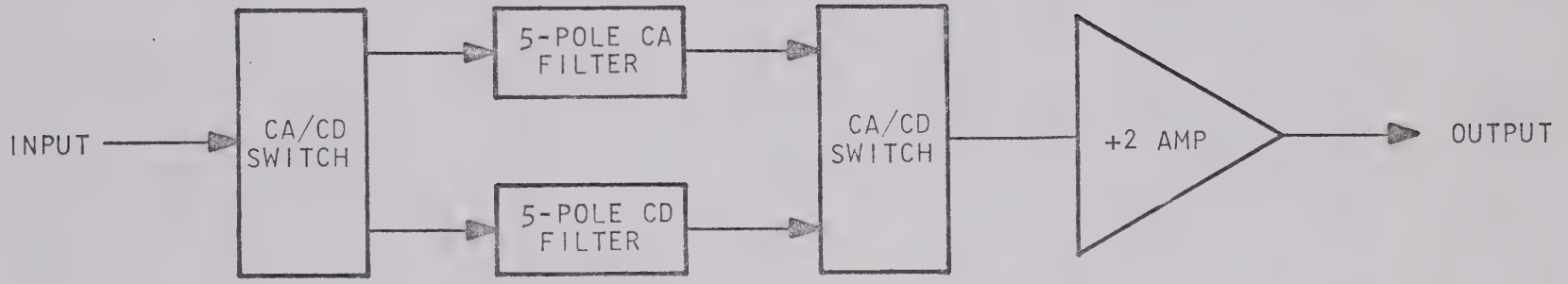


Figure 8-1. Model 4137 Output Filter Assembly Diagram



BLOCK DIAGRAM (LOW FREQUENCY VERSION)



BLOCK DIAGRAM (HIGH FREQUENCY VERSION)

Figure 8-2. Model 4137-05 5-Pole Filter Block Diagrams

The high frequency filter configuration contains two independent 5-pole, RLC filter networks and a +2 amplifier stage. Each filter network is designed to provide a specific response characteristic (CA or CD). Front-panel CA/CD switch couples the input and output through the required filter network.

8.2.2 Model 4137-06

The electrical configurations of the output filter are shown in the block diagram, Figure 8-3. The low frequency filter configuration consists of a 3-pole network, a 4-pole network, and active amplifier circuits. Each filter network is made up of RC combinations connected in a basic low-pass configuration using RC synthesis. Active components are used to provide isolation between filter sections and to adjust the overall gain of the filter. Two amplifiers (-2 and -1) provide a voltage gain of approximately +2. Front-panel response switch S1 selects appropriate feedback components establishing the filter response type.

The high frequency filter configuration contains two independent 7-pole, RLC filter networks and a +2 amplifier stage. Each filter network is designed to provide a specific response characteristic (CA or CD). Front-panel CA/CD switch couples the input and output through the required filter network.

8.3 FILTER CHARACTERISTICS

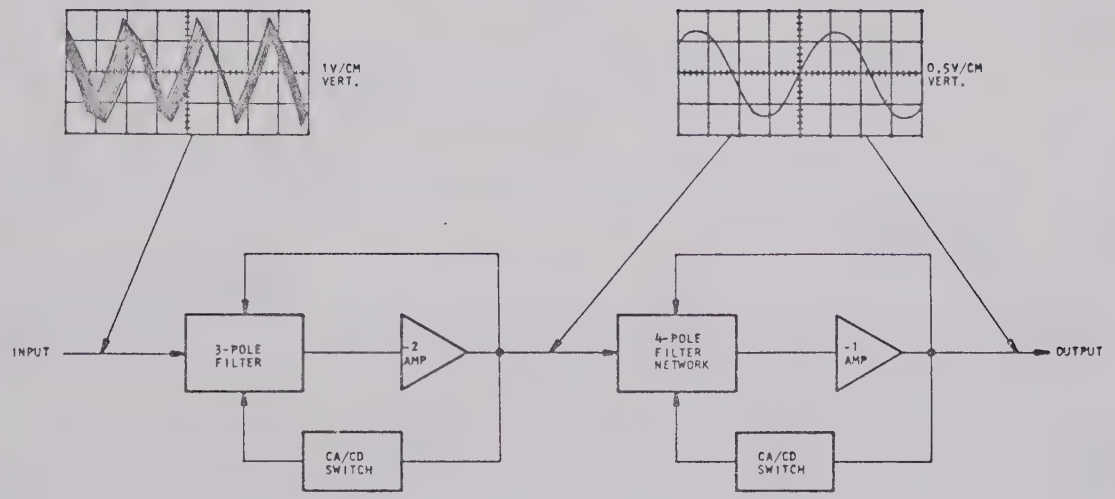
The typical response characteristics and asymptotic rolloff for the 5-pole and 7-pole output filters are illustrated in Figures 8-4 and 8-5. Filter attenuation at specific frequencies is as shown below:

4137-05

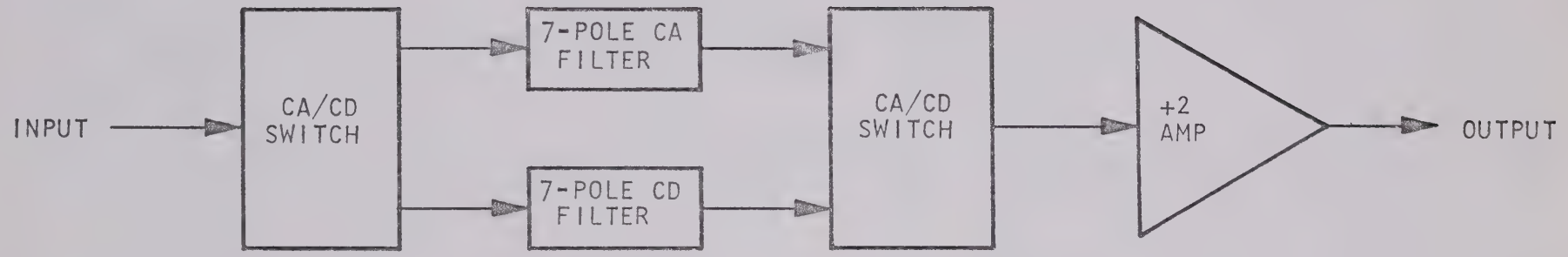
TYPE RESP.	0	0.5 F_{co}	1.0 F_{co}	2.0 F_{co}	4.0 F_{co}
CA	0	0±0.1 Db	-0.5±0.3 Db	-21.0±2 Db	>-49 Db
CD	0	-0.72±0.1 Db	-3.0±0.5 Db	-14.0±1.5 Db	>-36 Db

4137-06

TYPE RESP.	0	0.5 F_{co}	1.0 F_{co}	2.0 F_{co}	4.0 F_{co}
CA	0	0+0.1 Db	-0.5+0.3 Db	-33.0+2.0 Db	>-60 Db
CD	0	-0.73+0.1 Db	-3.0+0.5 Db	-14.0+1.5 Db	>-45 Db



BLOCK DIAGRAM (LOW FREQUENCY VERSION)



BLOCK DIAGRAM (HIGH FREQUENCY VERSION)

Figure 8-3. Model 4137-06 7-Pole Output Filter Block Diagrams

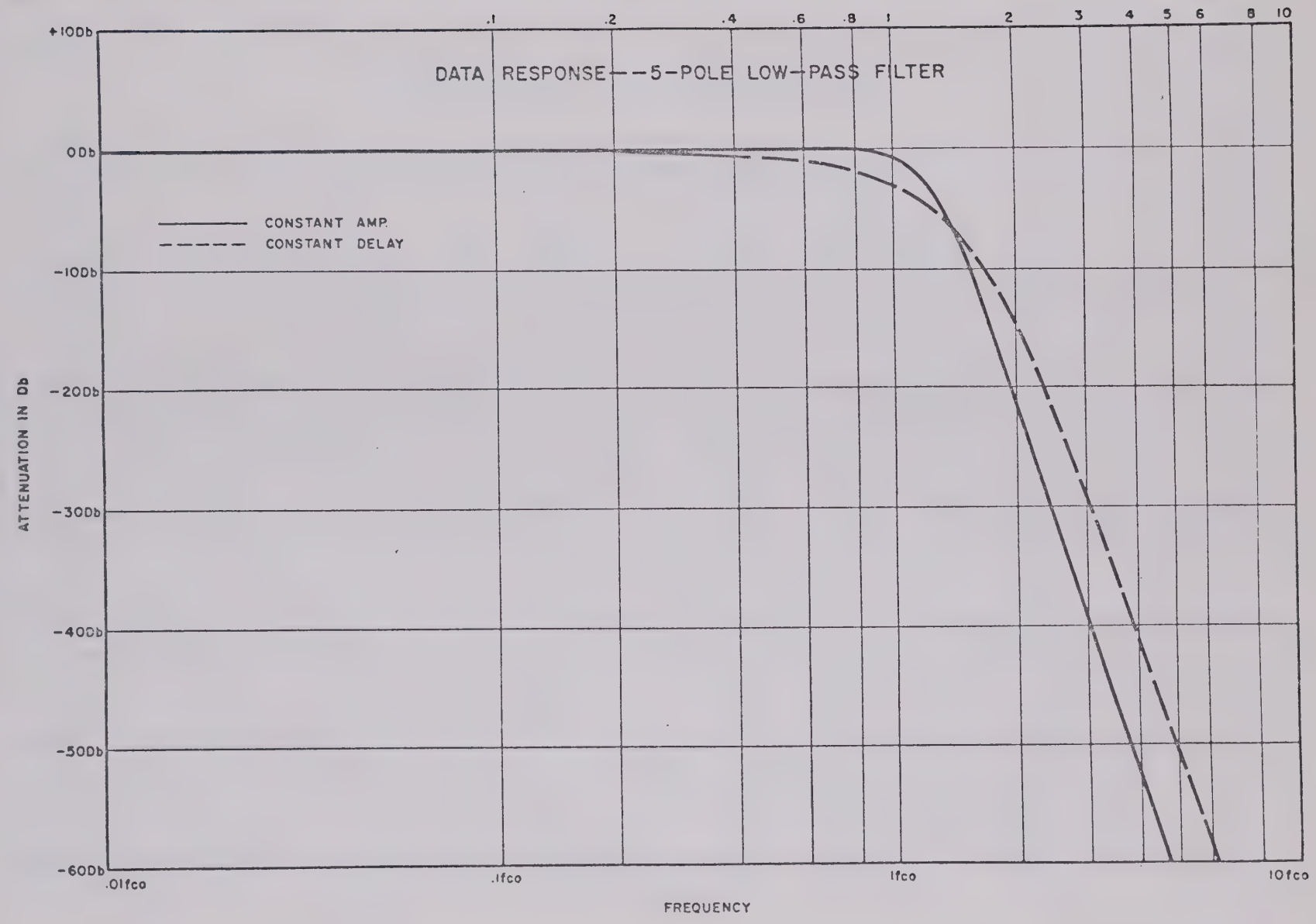


Figure 8-4. Response Characteristics of 5-Pole Low-Pass Output Filter

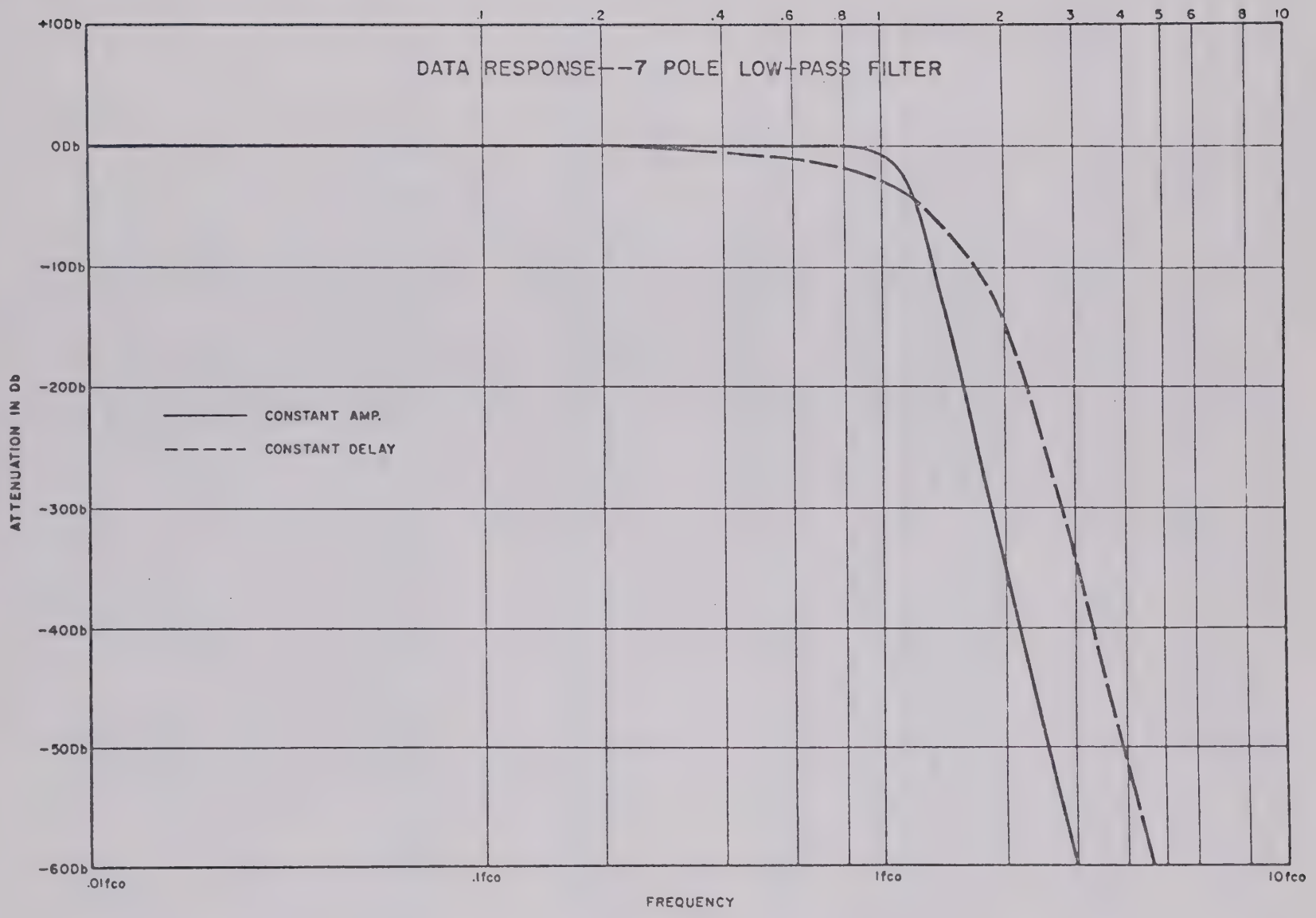


Figure 8-5. Response Characteristics of 7-Pole Low-Pass Output Filter

8.4 MAINTENANCE

Output filter maintenance is divided into three categories; general inspection routine, troubleshooting, and repair. An inspection should be performed periodically to ensure that all mechanical components are secured and that all electrical components including internal wiring are properly installed.

If a malfunction occurs, an inspection of the unit may indicate the problem. However, if an electrical failure occurs, troubleshoot the unit using the block diagram, circuit waveforms, assembly diagrams, and schematic diagrams provided.

The waveforms, shown in Figures 8-2 and 8-3, are typical for a subcarrier signal input to the discriminator with a modulating frequency below the output filter cutoff and for full channel deviation. The amplitude levels at the points at which the waveforms are referenced should be closely observed since the amplifier stages of the filter have fixed gain settings. Gain settings are identified within the amplifier symbols shown in the block diagram.

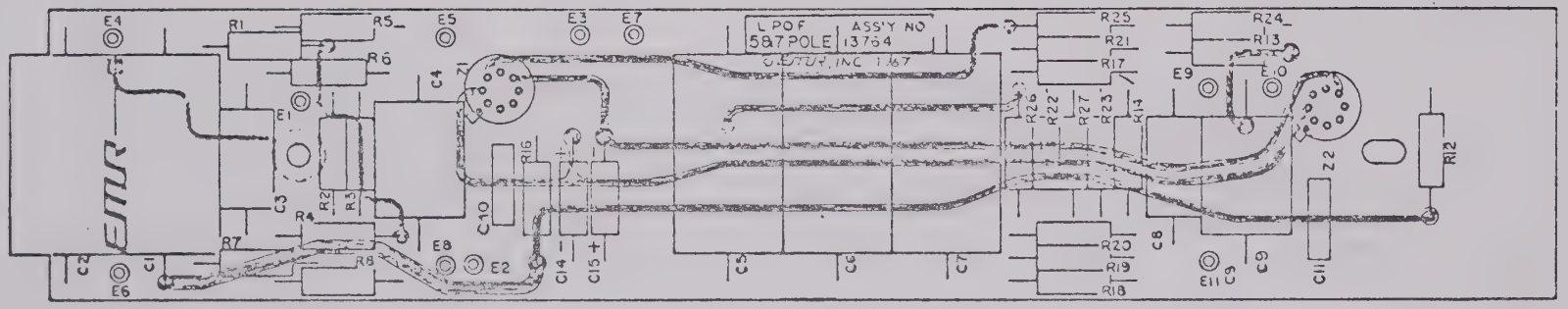
For most electrical failures, replacement of the amplifier modules will correct the malfunction. Any component of the output filter found to be defective may be replaced without degrading operation.

8.5 DRAWINGS

The top assembly drawing for the output filter is shown in Figure 8-1. Drawings illustrating the printed-circuit cards and schematic diagrams for the output filters are shown in Figures 8-6 through 8-11.

8.6 PARTS LISTS

The parts lists for the Models 4137-05 and 4137-06 are contained in Tables 8-1 and 8-2. Information describing the parts list breakdown, parts provisioning, and ordering information is contained in Section 6 of this manual.



NOTES:

1. EMR DWG. NO. 13764, REV. D

Figure 8-6. Models 4137-05 and 4137-06 Output Filters Printed-Circuit Card Assembly Diagram
(Used for cutoff frequencies below 1 KHz)

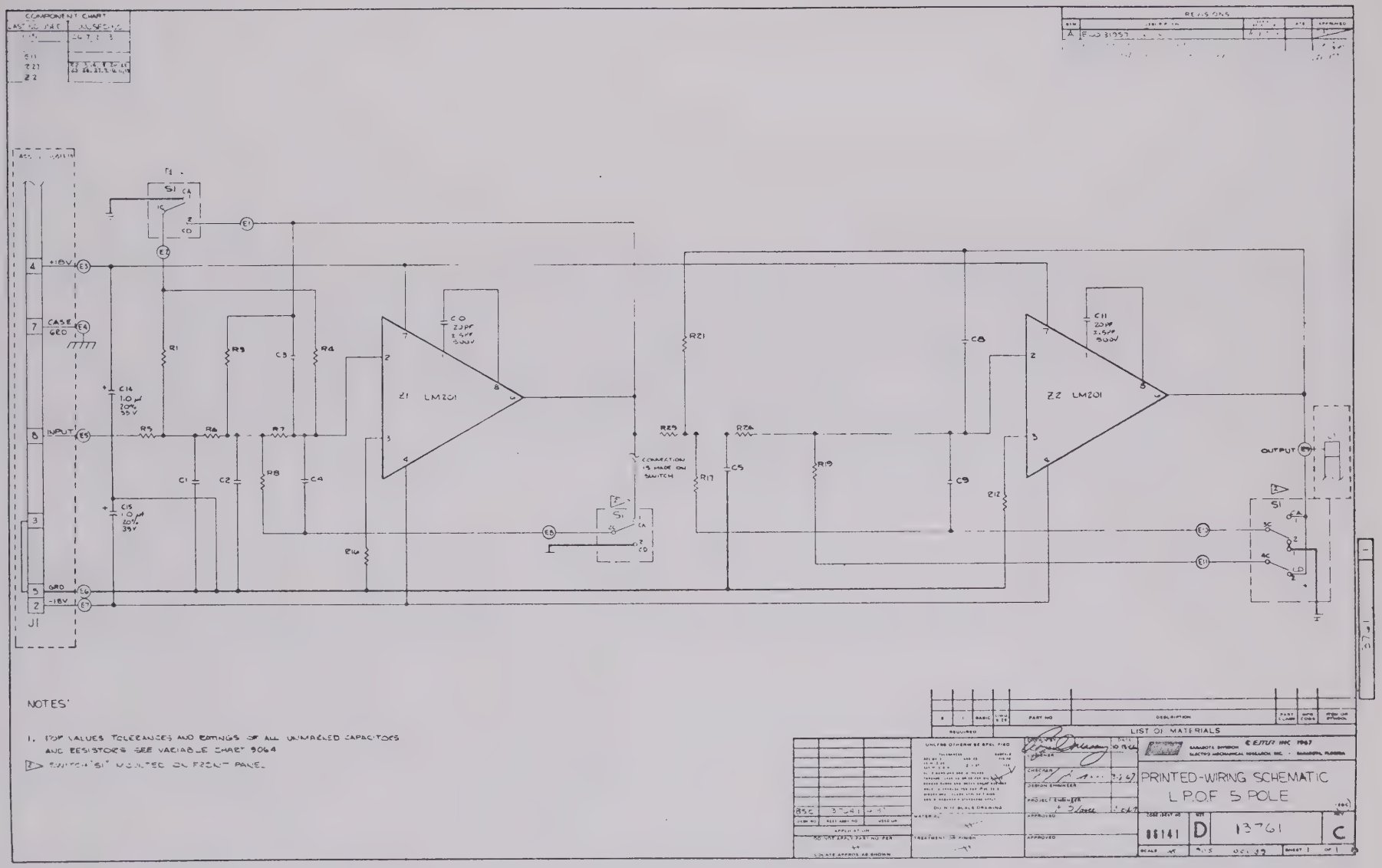


Figure 8-7. Model 4137-05 Output Filter Schematic Diagram
(Used for cutoff frequencies below 1 KHz)

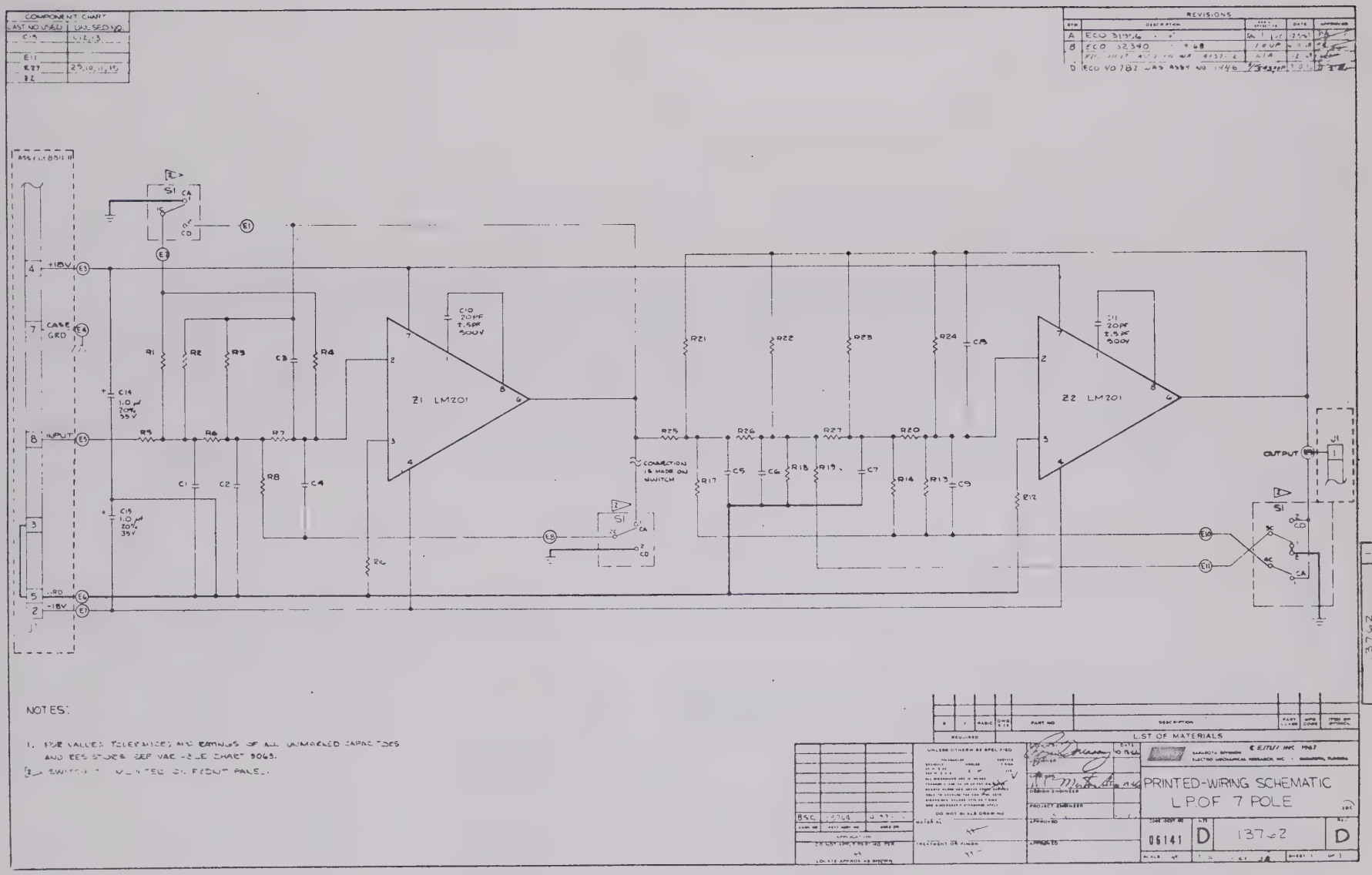


Figure 8-8. Model 4137-06 Output Filter Schematic Diagram
(Used for cutoff frequencies below 1 KHz)

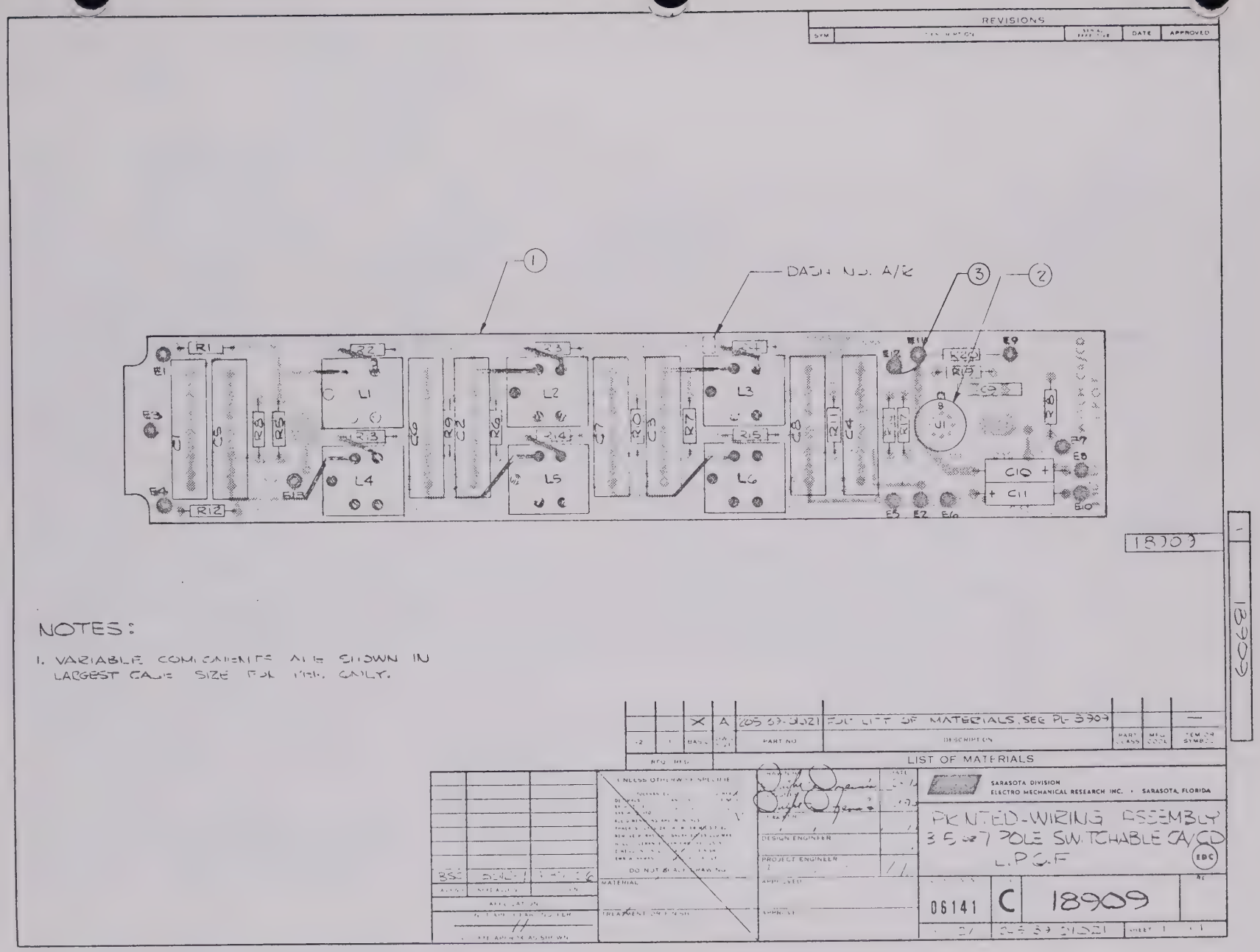


Figure 8-9. Models 4137-05 and 4137-06 Output Filters Printed-Circuit Card Assembly Diagram (Used for cutoff frequencies of 1 KHz through 450 KHz)

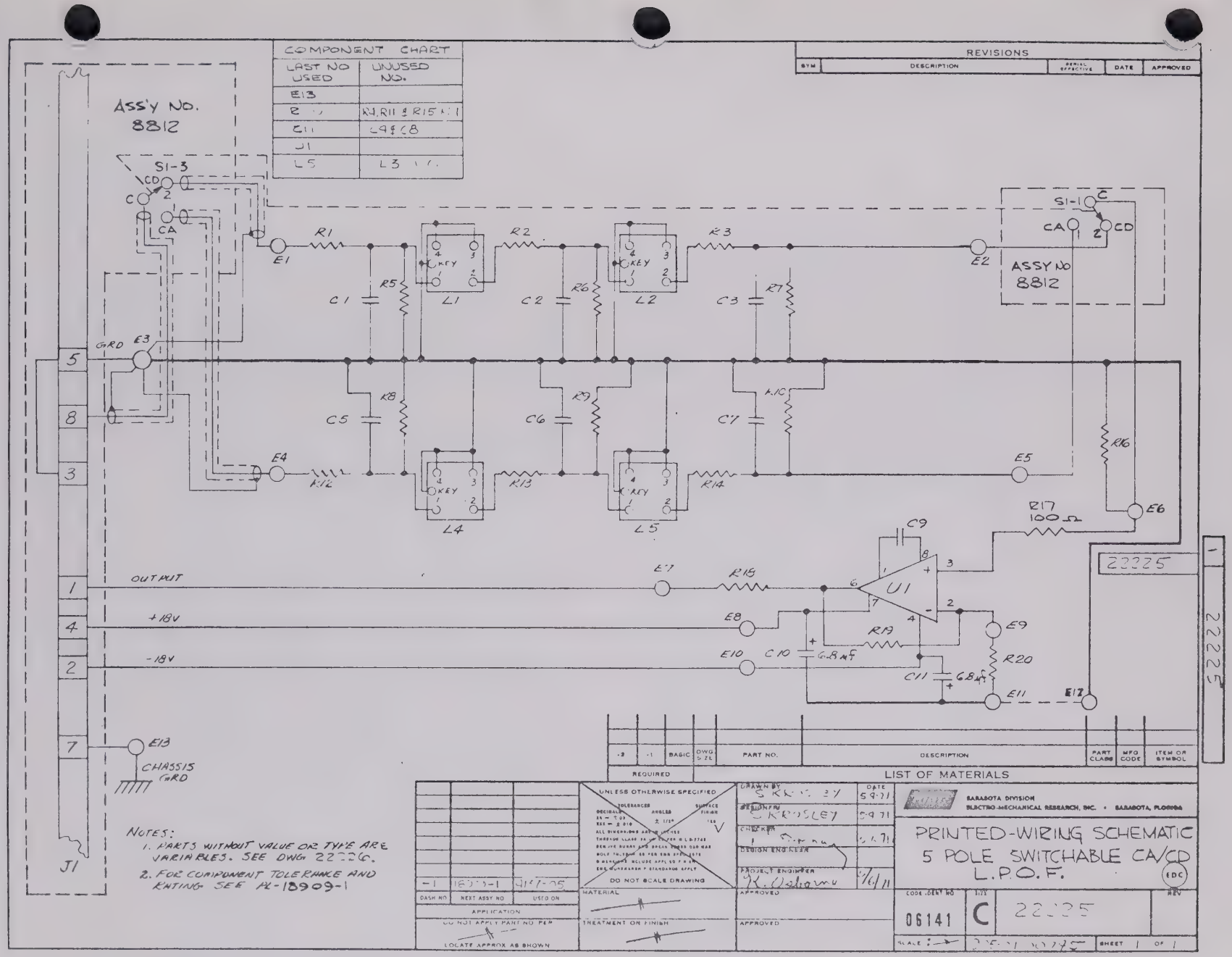


Figure 8-10. Model 4137-05 Output Filter Schematic Diagram
(Used for cutoff frequencies of 1 KHz through 450 KHz)

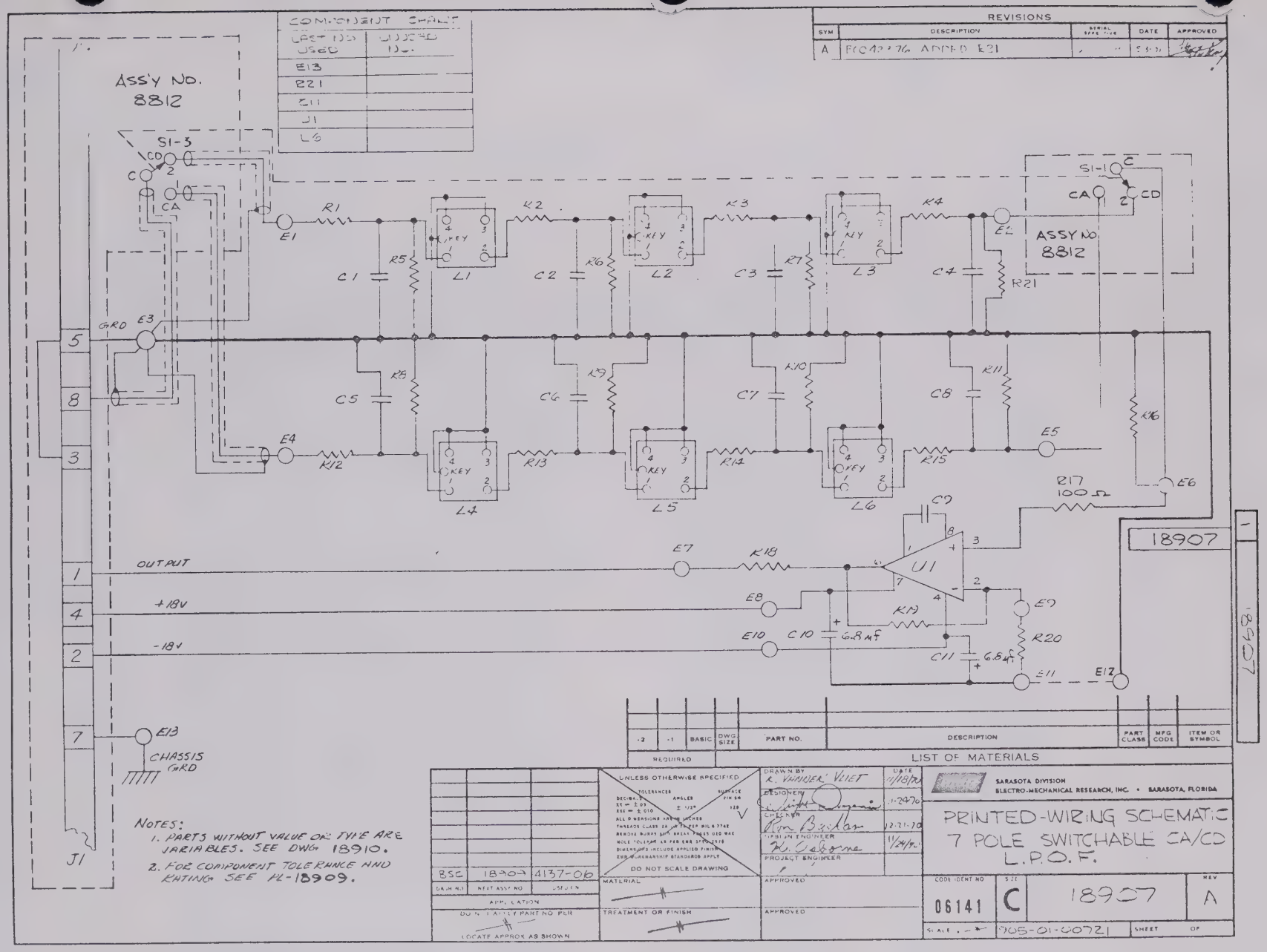


Figure 8-11. Model 4137-06 Output Filter Schematic Diagram
(Used for cutoff frequencies of 1 KHz through 450 KHz)

Table 8-1. Model 4137-05 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4137-05 OUTPUT FILTER ASSEMBLY	114-89-00033	06141	8812-10 (Rev. E)	1		
	KNOB, Light Green	148-99-00014	06141	6076	1		
	KNOB, Dark Green	148-99-00022	06141	6076-1	1		
	KNOB, Black	148-99-00023	06141	6076-2	1		
P1	CONNECTOR, Receptacle, 8-Pin	063-98-00036	02660	26-4200-83	1		
S1	SWITCH, Modified, Rotary, 4-Pole, 2-Position	250-89-00021	06141	8009-3	1		
	PRINTED-WIRING ASSEMBLY, 5-Pole LPOF (Used for frequencies below 1 KHz; ref. Figure 8-6)	205-89-00308	06141	13764-1 (Rev. B)	1		
C1	CAPACITOR, Frequency Variable	999-01-00015	06141	9064	1		
C2	CAPACITOR, Frequency Variable	999-01-00016	06141	9064	1		
C3	CAPACITOR, Frequency Variable	999-01-00017	06141	9064	1		
C4	CAPACITOR, Frequency Variable	999-01-00018	06141	9064	1		
C5	CAPACITOR, Frequency Variable	999-01-00019	06141	9064	1		
C8	CAPACITOR, Frequency Variable	999-01-00020	06141	9064	1		
C9	CAPACITOR, Frequency Variable	999-01-00021	06141	9064	1		
C10 & C11	CAPACITOR, 20 Pf ±.5 Pf, 500V	304-08-02009	06141	600	2		
C14 & C15	CAPACITOR, 1.0 μf ±10%, 35V	336-14-10003	06141	601	2		
R1	RESISTOR, Frequency Variable	999-01-00001	06141	9064	1		
R3	RESISTOR, Frequency Variable	999-01-00002	06141	9064	1		
R4	RESISTOR, Frequency Variable	999-01-00003	06141	9064	1		
R5	RESISTOR, Frequency Variable	999-01-00004	06141	9064	1		
R6	RESISTOR, Frequency Variable	999-01-00005	06141	9064	1		
R7	RESISTOR, Frequency Variable	999-01-00006	06141	9064	1		
R8	RESISTOR, Frequency Variable	999-01-00007	06141	9064	1		
R12	RESISTOR, Frequency Variable	999-01-00014	06141	9064	1		
R16	RESISTOR, Frequency Variable	999-01-00008	06141	9064	1		
R17	RESISTOR, Frequency Variable	999-01-00012	06141	9064	1		
R19	RESISTOR, Frequency Variable	999-01-00013	06141	9064	1		
R21	RESISTOR, Frequency Variable	999-01-00009	06141	9064	1		
R25	RESISTOR, Frequency Variable	999-01-00010	06141	9064	1		
R26	RESISTOR, Frequency Variable	999-01-00011	06141	9064	1		

Table 8-1 (Cont'd.). Model 4137-05 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
Z1 & Z2	INTEGRATED CIRCUIT, Opnl. Ampl.	046-97-00027	12040	LM201H or LM301AH	2		
	PRINTED-WIRING ASSEMBLY, 5-Pole LPOF (Used for frequencies of 1 KHz through 450 KHz; ref. Figure 8-9)	205-89-01054	06141	18909-1 (Rev. A)	1		
C1	CAPACITOR, Frequency Variable	999-01-00001	06141	22226	1		
C2	CAPACITOR, Frequency Variable	999-01-00002	06141	22226	1		
C3	CAPACITOR, Frequency Variable	999-01-00003	06141	22226	1		
C5	CAPACITOR, Frequency Variable	999-01-00005	06141	22226	1		
C6	CAPACITOR, Frequency Variable	999-01-00006	06141	22226	1		
C7	CAPACITOR, Frequency Variable	999-01-00007	06141	22226	1		
C9	CAPACITOR, Frequency Variable	999-01-00009	06141	22226	1		
C10 & C11	CAPACITOR, 6.8 µf ±10%, 35V	337-14-68003	06141	601	2		
L1	INDUCTOR, Frequency Variable	999-01-00010	06141	22226	1		
L2	INDUCTOR, Frequency Variable	999-01-00011	06141	22226	1		
L4	INDUCTOR, Frequency Variable	999-01-00013	06141	22226	1		
L5	INDUCTOR, Frequency Variable	999-01-00014	06141	22226	1		
R1	RESISTOR, Frequency Variable	999-01-00016	06141	22226	1		
R2	RESISTOR, Frequency Variable	999-01-00017	06141	22226	1		
R3	RESISTOR, Frequency Variable	999-01-00018	06141	22226	1		
R5	RESISTOR, Frequency Variable	999-01-00020	06141	22226	1		
R6	RESISTOR, Frequency Variable	999-01-00021	06141	22226	1		
R7	RESISTOR, Frequency Variable	999-01-00022	06141	22226	1		
R8	RESISTOR, Frequency Variable	999-01-00023	06141	22226	1		
R9	RESISTOR, Frequency Variable	999-01-00024	06141	22226	1		
R10	RESISTOR, Frequency Variable	999-01-00025	06141	22226	1		
R12	RESISTOR, Frequency Variable	999-01-00027	06141	22226	1		
R13	RESISTOR, Frequency Variable	999-01-00028	06141	22226	1		
R14	RESISTOR, Frequency Variable	999-01-00029	06141	22226	1		
R16	RESISTOR, Frequency Variable	999-01-00031	06141	22226	1		
R17	RESISTOR, 100.0Ω ±1%, 1/10W	608-09-10009	06141	624	1		
R18	RESISTOR, Frequency Variable	999-01-00032	06141	22226	1		
R19	RESISTOR, Frequency Variable	999-01-00033	06141	22226	1		

Table 8-1 (Cont'd.). Model 4137-05 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R20	RESISTOR, Frequency Variable	999-01-00034	06141	22226	1		
U1	INTEGRATED CIRCUIT, Frequency Variable	999-01-00035	06141	22226	1		

Table 8-2. Model 4137-06 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4137-06 OUTPUT FILTER ASSEMBLY	114-89-00034	06141	8812-11 (Rev.C)	1		
	KNOB, Light Green	148-99-00014	06141	6076	1		
	KNOB, Dark Green	148-99-00022	06141	6076-1	1		
	KNOB, Black	148-99-00023	06141	6076-2	1		
P1	CONNECTOR, Receptacle, 8-Pin, R and P	063-98-00036	02660	26-4200-83	1		
S1	SWITCH, Modified, Rotary, 4-Pole, 2-Position	250-89-00021	06141	8009-3	1		
	PRINTED-WIRING ASSY., 7-Pole LPOF (Used for frequencies below 1 KHz; ref. Fig. 8-6)	205-89-00307	06141	13764 (Rev. B)	1		
C1	CAPACITOR, Frequency Variable	999-01-00024	06141	9065	1		
C2	CAPACITOR, Frequency Variable	999-01-00025	06141	9065	1		
C3	CAPACITOR, Frequency Variable	999-01-00026	06141	9065	1		
C4	CAPACITOR, Frequency Variable	999-01-00027	06141	9065	1		
C5	CAPACITOR, Frequency Variable	999-01-00028	06141	9065	1		
C6	CAPACITOR, Frequency Variable	999-01-00029	06141	9065	1		
C7	CAPACITOR, Frequency Variable	999-01-00030	06141	9065	1		
C8	CAPACITOR, Frequency Variable	999-01-00031	06141	9065	1		
C9	CAPACITOR, Frequency Variable	999-01-00032	06141	9065	1		
C10 & C11	CAPACITOR, 20 Pf ±.5 Pf, 500V	304-08-02009	06141	600	2		
C14 & C15	CAPACITOR, 1 Mf ±20%, 35V	336-23-10003	06141	601	2		
R1	RESISTOR, Frequency Variable	999-01-00001	06141	9065	1		
R2	RESISTOR, Frequency Variable	999-01-00002	06141	9065	1		
R3	RESISTOR, Frequency Variable	999-01-00003	06141	9065	1		
R4	RESISTOR, Frequency Variable	999-01-00004	06141	9065	1		
R5	RESISTOR, Frequency Variable	999-01-00005	06141	9065	1		
R6	RESISTOR, Frequency Variable	999-01-00006	06141	9065	1		
R7	RESISTOR, Frequency Variable	999-01-00007	06141	9065	1		
R8	RESISTOR, Frequency Variable	999-01-00008	06141	9065	1		
R12	RESISTOR, Frequency Variable	999-01-00023	06141	9065	1		
R13	RESISTOR, Frequency Variable	999-01-00022	06141	9065	1		
R14	RESISTOR, Frequency Variable	999-01-00021	06141	9065	1		
R16	RESISTOR, Frequency Variable	999-01-00009	06141	9065	1		
R17	RESISTOR, Frequency Variable	999-01-00018	06141	9065	1		
R18	RESISTOR, Frequency Variable	999-01-00019	06141	9065	1		

Table 8-2 (Cont'd.). Model 4137-06 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R19	RESISTOR, Frequency Variable	999-01-00020	06141	9065	1		
R20	RESISTOR, Frequency Variable	999-01-00017	06141	9065	1		
R21	RESISTOR, Frequency Variable	999-01-00010	06141	9065	1		
R22	RESISTOR, Frequency Variable	999-01-00011	06141	9065	1		
R23	RESISTOR, Frequency Variable	999-01-00012	06141	9065	1		
R24	RESISTOR, Frequency Variable	999-01-00013	06141	9065	1		
R25	RESISTOR, Frequency Variable	999-01-00014	06141	9065	1		
R26	RESISTOR, Frequency Variable	999-01-00015	06141	9065	1		
R27	RESISTOR, Frequency Variable	999-01-00016	06141	9065	1		
Z1 & Z2	INTEGRATED CIRCUIT, Opnl. Amp.	046-97-00027	12040	LM201H or LM301AH	2		
	PRINTED-WIRING ASSY., 7-Pole CA/CD LPOF (Used for frequencies of 1 KHz through 450 KHz, ref. Figure 8-9)	205-89-01021	06141	18909 (Rev. C)	1		
C1	CAPACITOR, Frequency Variable	999-01-00001	06141	18910	1		
C2	CAPACITOR, Frequency Variable	999-01-00002	06141	18910	1		
C3	CAPACITOR, Frequency Variable	999-01-00003	06141	18910	1		
C4	CAPACITOR, Frequency Variable	999-01-00004	06141	18910	1		
C5	CAPACITOR, Frequency Variable	999-01-00005	06141	18910	1		
C6	CAPACITOR, Frequency Variable	999-01-00006	06141	18910	1		
C7	CAPACITOR, Frequency Variable	999-01-00007	06141	18910	1		
C8	CAPACITOR, Frequency Variable	999-01-00008	06141	18910	1		
C9	CAPACITOR, Frequency Variable	999-01-00009	06141	18910	1		
C10 & C11	CAPACITOR, 6.8 Mf ±10%, 35V	337-14-68003	06141	601	2		
L1	INDUCTOR, Frequency Variable	999-01-00010	06141	18910	1		
L2	INDUCTOR, Frequency Variable	999-01-00011	06141	18910	1		
L3	INDUCTOR, Frequency Variable	999-01-00012	06141	18910	1		
L4	INDUCTOR, Frequency Variable	999-01-00013	06141	18910	1		
L5	INDUCTOR, Frequency Variable	999-01-00014	06141	18910	1		
L6	INDUCTOR, Frequency Variable	999-01-00015	06141	18910	1		
R1	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00016	06141	18910	1		

Table 8-2 (Cont'd.). Model 4137-06 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R2	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00017	06141	18910	1		
R3	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00018	06141	18910	1		
R4	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00019	06141	18910	1		
R5	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00020	06141	18910	1		
R6	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00021	06141	18910	1		
R7	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00022	06141	18910	1		
R8	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00023	06141	18910	1		
R9	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00024	06141	18910	1		
R10	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00025	06141	18910	1		
R11	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00026	06141	18910	1		
R12	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00027	06141	18910	1		
R13	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00028	06141	18910	1		
R14	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00029	06141	18910	1		
R15	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00030	06141	18910	1		
R16	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00031	06141	18910	1		
R17	RESISTOR, 100Ω ±1%, 1/10W	608-09-10009	06141	624	1		
R18	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00032	06141	18910	1		

Table 8-2 (Cont'd.). Model 4137-06 Output Filter Parts List (Ref. Figure 8-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R19	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00033	06141	18910	1		
R20	RESISTOR, Frequency Variable, ±1%, 1/10W	999-01-00034	06141	18910	1		
R21	RESISTOR, Frequency Variable	999-01-00036	06141	18910	1		
U1	INTEGRATED CIRCUIT, Frequency Variable	999-01-00035	06141	18910	1		

ADDENDUM

EMR MODEL 4131-12-M8 CALIBRATING CHANNEL SELECTOR

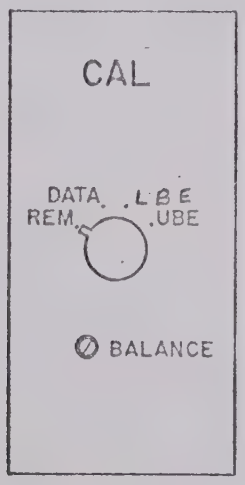
A.1 GENERAL

This addendum describes the changes to the standard 4131-12 Calibrating Channel Selector for the M8 configuration. The M8 configuration differes functionally from the standard unit in that the calibration points are upper bandedge (UBE) and lower bandedge (LBE). Changes in channel selector are described in paragraph A.2. This addendum should be used in conjunction with Appendix A (Models 4131-11, -12, -13, and -14 Calibrating Channel Selectors description) of the 4130 Subcarrier Discriminator Instruction Manual.

A.2 DESCRIPTION

The M8 configuration changes are listed as follows:

a. The front panel marking is changed to the following --



b. The remote calibration switching is the same as the standard unit except that the CAL 0 (center frequency select) input at rear connector J1 pin 9 is used to select LBE. UBE select is J1 pin 13.

c. Certain channel center frequencies supplied do not fall within the standard frequency range of the calibrator circuit. (Standard center frequency ranges are shown in Table A-1.) Therefore, the calibrator circuit crystals and frequency divider network jumpering is changed from that identified in Tables A-1 and A-2. The center frequencies, crystals, and jumpers supplied are listed as follows:

FREQ.	COMPONENT	EMR PART NO.	JUMPERING
70 kHz Unit	Y1 Y2	076-99-00344 076-99-00345	E9 to E8 E11 to E14
200 kHz Unit	Y1 Y2	076-99-00350 076-99-00351	E9 to E14
480 kHz Unit	Y1 Y2	076-99-00346 076-99-00347	E9 to E8 Z2 pin 10 to E14
800 kHz Unit	Y1 Y2	076-99-00348 076-99-00349	E9 to E14

APPENDIX A

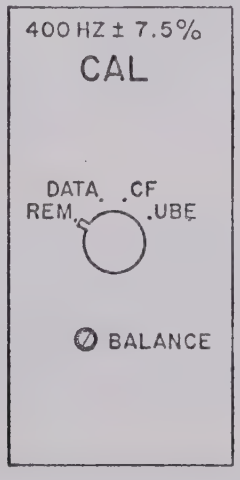
EMR MODELS 4131-11, -12, -13, AND -14 CALIBRATING CHANNEL SELECTORS (REVISION A)

A.1 GENERAL

This appendix contains information describing the 4131-11, -12, -13, and -14 Calibrating Channel Selectors. These channel selectors are identical to the 4131-01, -02, -03, and -04, respectively, except that a built-in calibrator is included in each channel selector. For information describing the 4131-01, -02, -03, and -04, refer to Section 7 of the 4130 Subcarrier Discriminator Instruction Manual. The information in this appendix includes only a description of the calibrator circuit and changes to the 4131-01, -02, -03, and -04 configurations in adding the calibrator.

A.2 DESCRIPTION

The calibrator provided on the channel selectors is effectively the same regardless of the channel selector configurations. Only the frequencies of the calibrator (and certain frequency divider components) change depending on the selected frequency and deviation of the channel selector. Center frequency and high-bandedge frequencies are provided for each channel. A front panel view of the 4131-11, -12, -13, and -14 is shown as follows:



With the front panel CAL switch in the REM position, the calibrator switching (CAL-DATA) is performed by a remote source. In the DATA position, the incoming subcarrier or multiplex is coupled through the calibrator circuit to the band-pass input filter the same as the standard 4131-01, -02, -03, or -04.

The CF and UBE positions of the CAL switch interrupt the normal operation and instead supplies precision frequencies to the channel selector circuits. In the CF position, the channel center frequency is supplied; in the UBE position, the channel upper-bandedge frequency is supplied.

The remote control line inputs to the 4130 Basic Unit rear connector are listed as follows:

J1 pin 9	-- CAL 0 (center frequency select).
J1 pin 13	-- CAL SENSE (upper-bandedge frequency select).
J1 pins 2 or 15	-- Ground connection.

The voltage required to switch from the normal data mode to one of the calibrate modes is 18 volts ±0.5 volt applied to either J1 pins 9 or 13 depending on the desired mode. With no voltage on J1 pins 9 or 13, the normal data mode is automatically selected.

With the calibrating channel selector installed in the Model 4130 Basic Unit, the discriminator balance and bandedge voltage can be adjusted using the calibrate modes. To initially balance the discriminator, set the CAL switch to CF. Monitor the discriminator data output with a DC voltmeter and adjust the front panel BALANCE control for a 0-volt output. Switch the CAL switch position to UBE and adjust the front panel BE VOLTS control for the desired bandedge voltage output. Return the CAL switch to the DATA position.

A.3 THEORY OF OPERATION

The calibrator circuit in the channel selectors is shown schematically in Figure A-1. With the front panel CAL switch in the DATA position, the FM multiplex or single-channel input to the discriminator is coupled from pin 14 through the normally closed (NC) contacts of relay K1 to the BPIF circuit on the channel selector card. The calibrator circuit is thus bypassed and the discriminator operation is the same as that described for the 4131-01, -02, -03, or -04 in the 4130 manual.

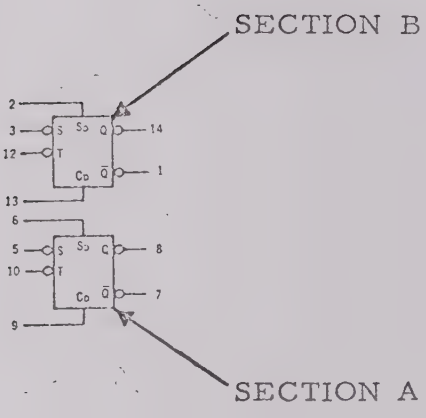
When the CAL switch is positioned to CF or UBE, an 18-volt level (from terminal E9) is applied to one of the crystal oscillator circuits and to relay K1. The oscillator circuit is turned on supplying a precision frequency output to a frequency divider network Z1, Z2, Z8, Z9, and Z10. The output from this divider network is coupled to terminal E14 and is then supplied through K1 to the BPIF on the channel selector card.

The fundamental frequency of the crystal oscillators and the number of divider stages used is dependent upon the frequency and deviation of the channel selector. Also, the jumper wires between divider stages and the jumper to terminal E14 (calibrator output) are dependent upon the center frequency. The divider stages used for channel frequencies are listed in Table A-1. Jumper wires used for the divider are listed in Table A-2.

When the remote (REM) position is selected, the switching is performed at the CAL 0 or CAL SENSE inputs. If neither line is active, the data mode is automatically selected. With a +18-volt level applied to one of the CAL input

lines, the selected crystal oscillator is turned on and relay K1 is energized. The selected calibration frequency is thus coupled to the channel selector BPIF.

Each of the divider stages, Z1/Z2/Z8/Z9/Z10, contains two flip-flop circuits which divide the input frequency by 2. Therefore, the crystal oscillator fundamental frequency can be divided by a minimum of 2 or up to a maximum of 1024 depending on the number of stages used. The internal logic of each integrated circuit is shown in the following diagram along with a pin function list.



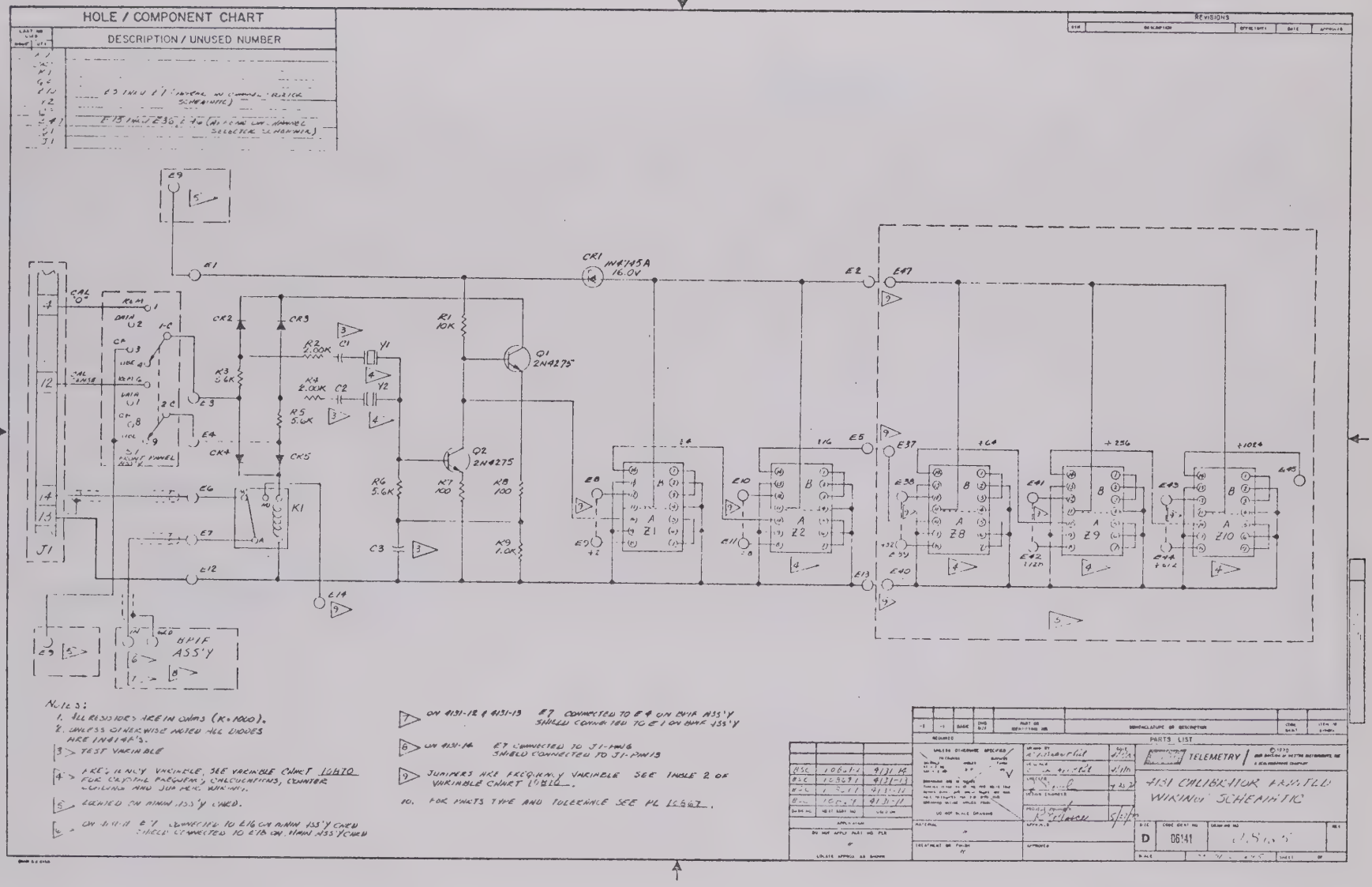
PIN	PIN FUNCTIONS
1	B $\overline{\text{OUTPUT}}$
2	GROUND
3	SET INPUT TO B
4	(NOT USED)
5	SET INPUT TO A
6	GROUND
7	A $\overline{\text{OUTPUT}}$
8	A OUTPUT
9	GROUND
10	A CLOCK INPUT
11	(NOT USED)
12	B CLOCK INPUT
13	GROUND
14	B OUTPUT

A.4 DRAWINGS AND PARTS LISTS

The top assembly diagram for the 4131-11, -12, -13, and -14 is identical to that shown for the 4131-01, -02, -03, and -04 in Figure 7-1 of the 4130 manual, except that the front panel CAL switch A1S1 is included. The location of the calibrator card on the channel selector card is shown in Figure A-2. The channel selector cards are illustrated in Section 7 of the 4130 manual. The calibrator card assembly diagram is shown in Figure A-3.

Five wiring diagrams are provided to illustrate the internal wiring of the 4131-11, -12, -13, and -14. These diagrams are illustrated in Figures A-4 through A-8.

The parts lists for the calibrating channel selectors are contained in Tables A-3 through A-6. Tables A-3, A-4, and A-5 are top assembly parts lists, while Table A-6 is the calibrator card parts list. Certain parts lists in the calibrated channel selectors are similar to parts lists contained in Section 7 of the 4130 manual. When this is the case, reference is made to the appropriate Section 7 parts list. The breakdown of the parts list tables is fully described in Section 6 of the 4130 manual.



NOTES:
1. ALL RESISTORS ARE IN OHMS (K = 1000).
2. UNLESS OTHERWISE NOTED ALL DIODES ARE IN4148's.
3. TEST VARIABLE
4. R#'s IS ONLY VARIABLE, SEE VARIABLE CHART 10410 FOR CRYSTAL FREQUENCY CALCULATIONS, COUNTER CYCLING AND SUB-MIC. WARNING.
5. LOCATED ON MAIN ASS'Y CHART.
6. ON 4131-11 E7 CONNECTED TO E16 ON MAIN ASS'Y CHART SHELL CONNECTED TO E14 ON MAIN ASS'Y CHART

A. ON 4131-12 & 4131-13 E7 CONNECTED TO E4 ON UHF ASS'Y SHELL CONNECTED TO E1 ON UHF ASS'Y
B. ON 4131-14 E7 CONNECTED TO J1-PIN 6 SHELL CONNECTED TO J1-PIN 13
D. JUMPERS ARE FREQUENCY VARIABLE SEE NOTE 2 OF VARIABLE CHART 10410.
10. FOR PARTS TYPE AND TOLERANCE SEE PL 10362.

A-5

Figure A-1. Calibrator Schematic Diagram

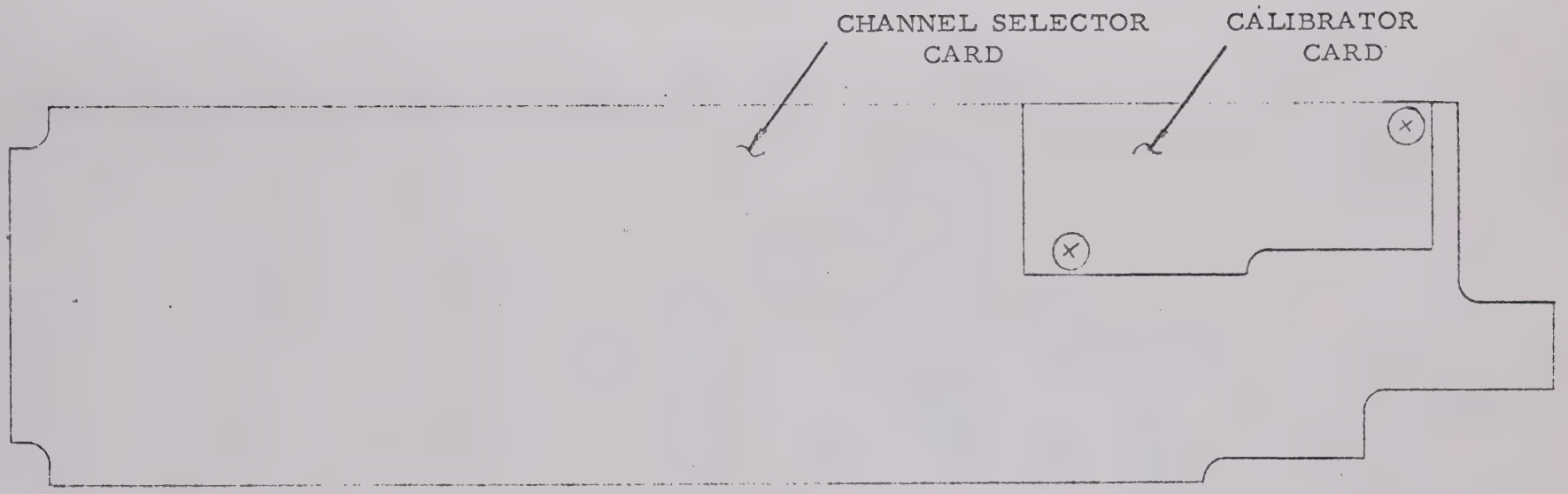


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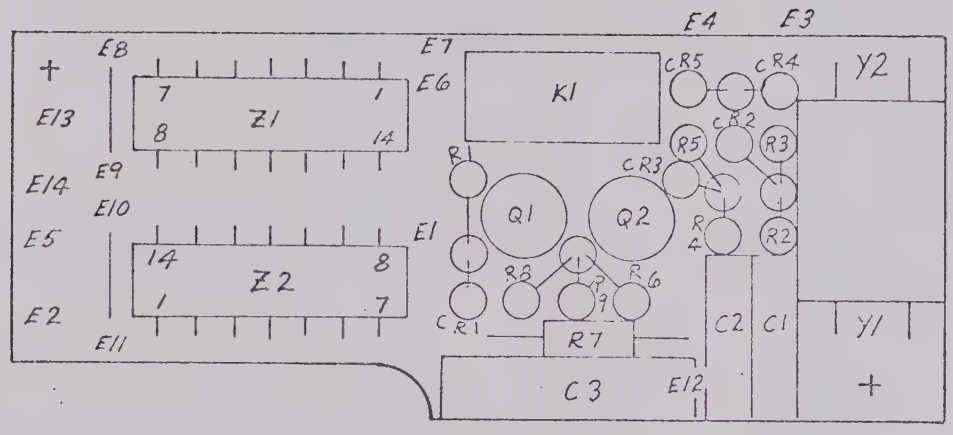
Figure A-2. Channel Selector Card/Calibrator Card Location Diagram



Made From EMR Dwg. 10867

Figure A-3. Calibrator Card Assembly Diagram

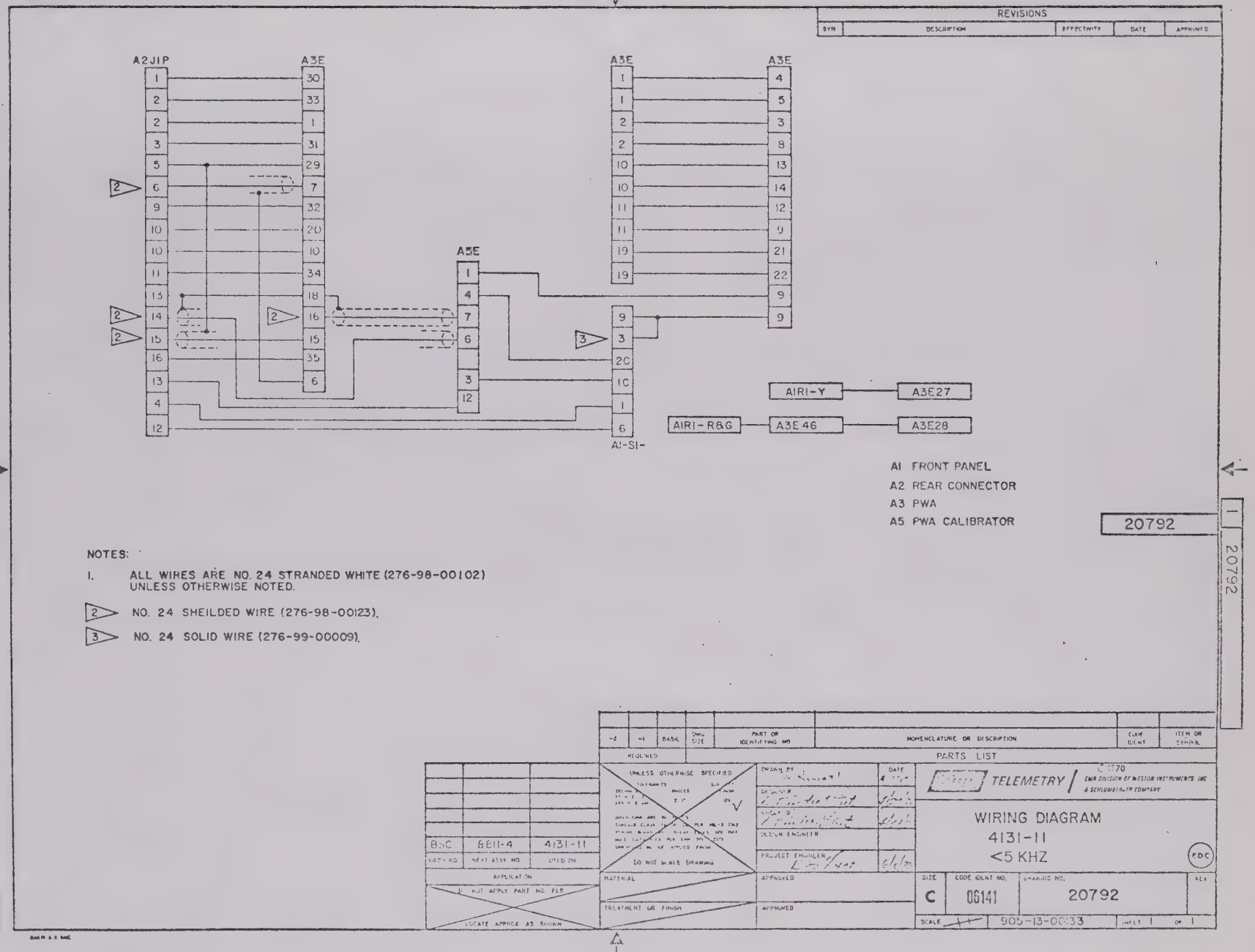


Figure A-4. Model 4131-11 Wiring Diagram (For Center Frequencies <5 kHz)

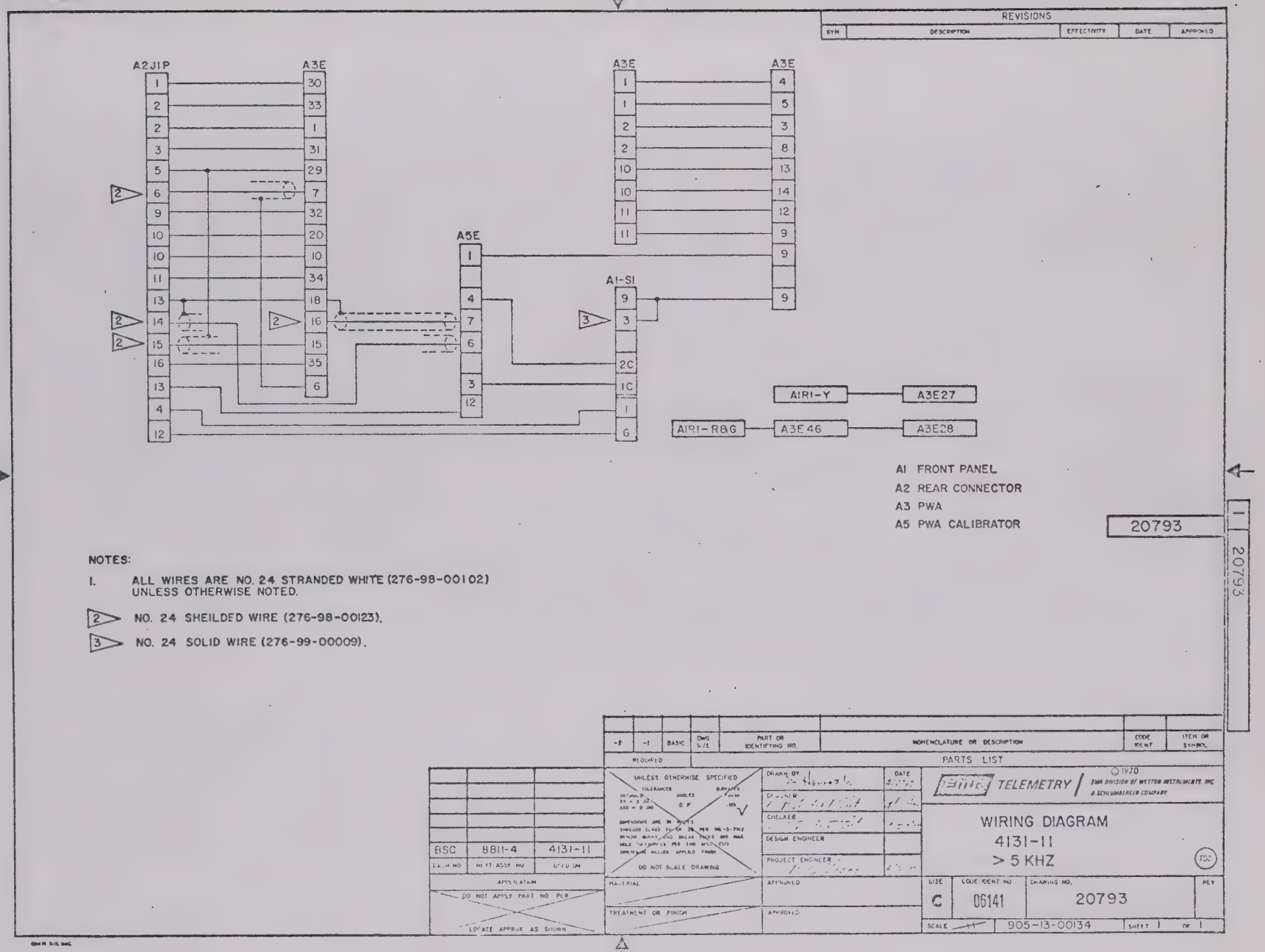


Figure A-5. Model 4131-11 Wiring Diagram (For Center Frequencies >5 kHz)

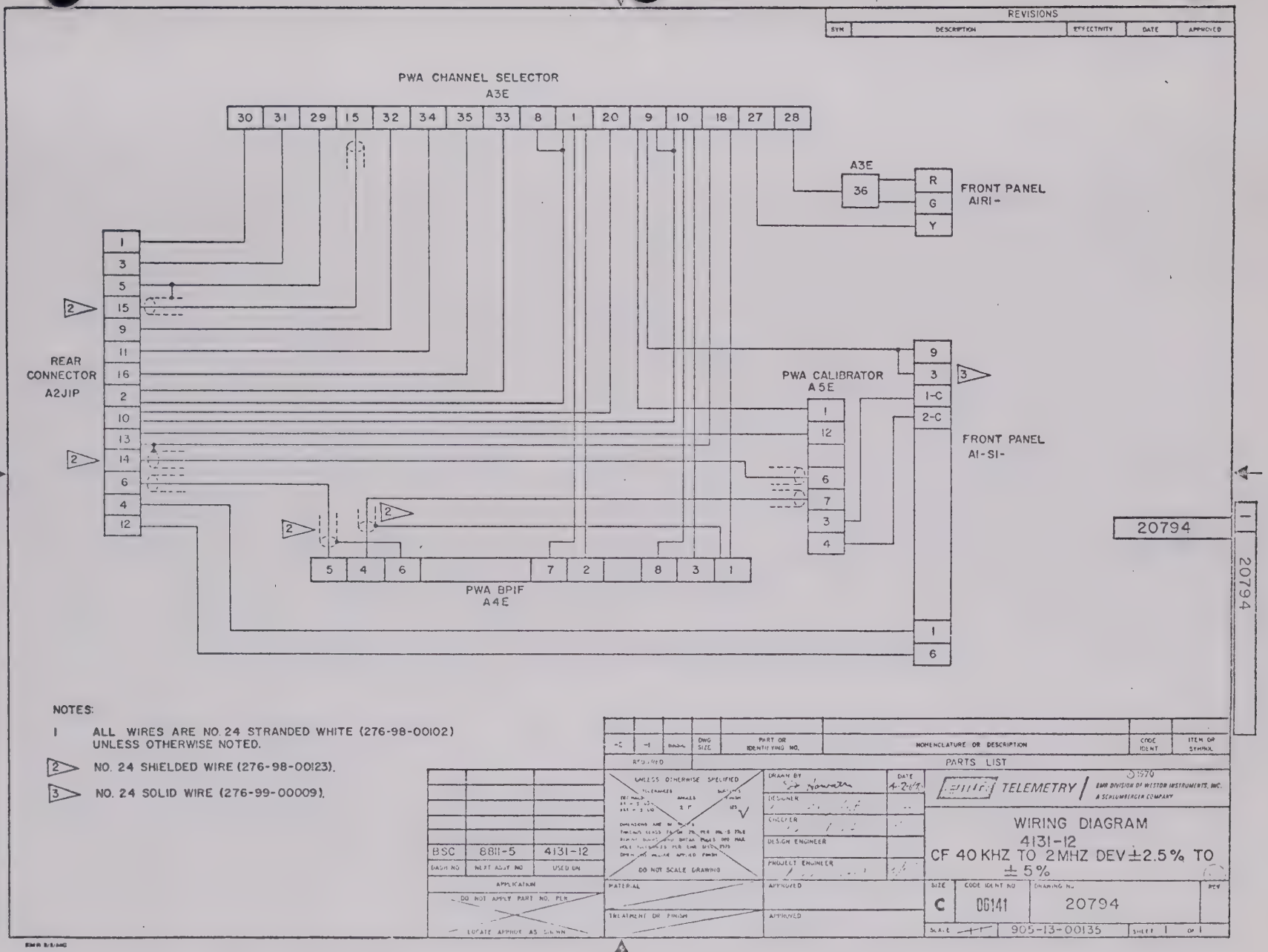


Figure A-6. Model 4131-12 Wiring Diagram
(For Center Frequencies of 40 kHz to 2 MHz and Deviations of 2.5% to 5%)

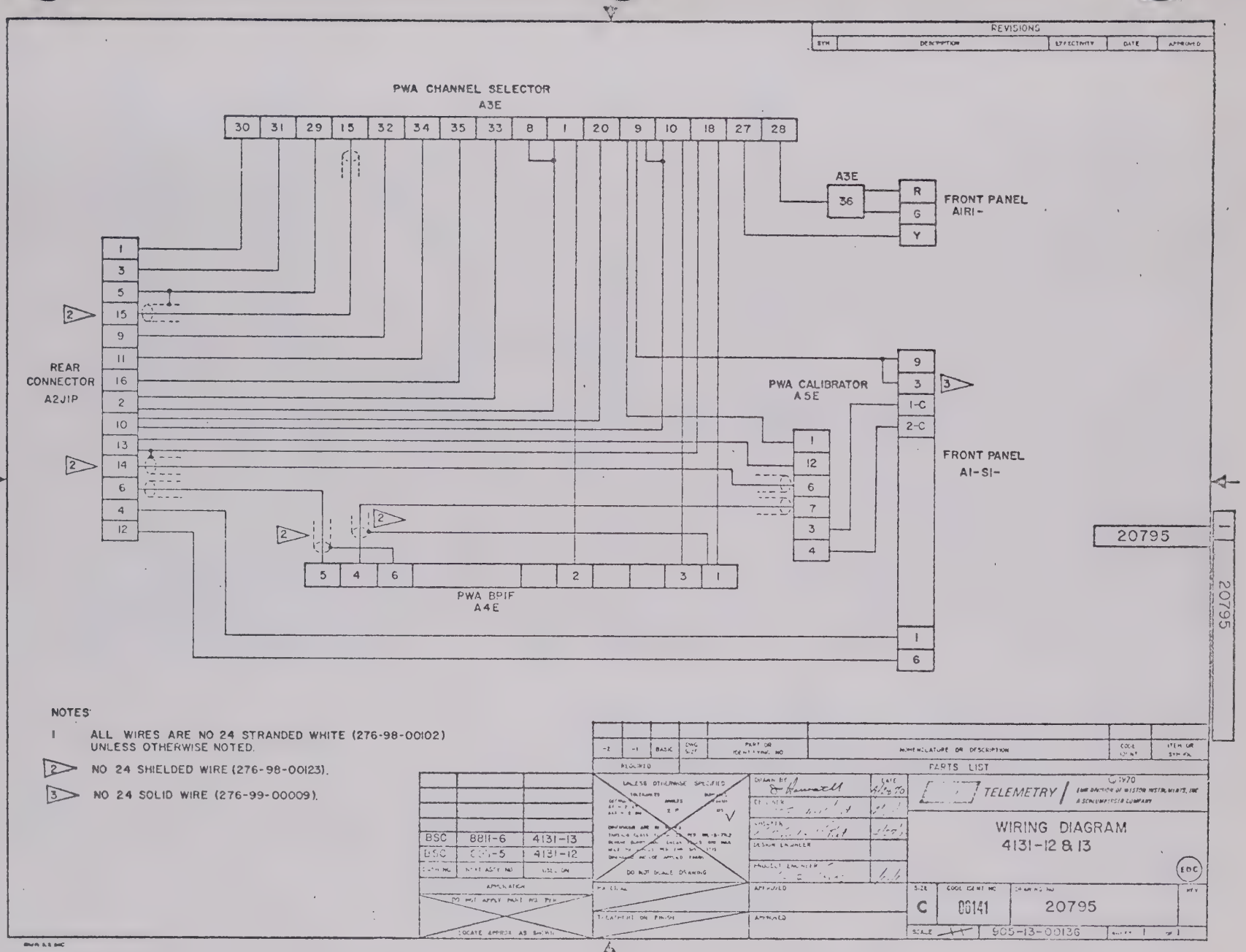


Figure A-7. Models 4131-12 and -13 Wiring Diagram (Except as Noted in Figure A-6)

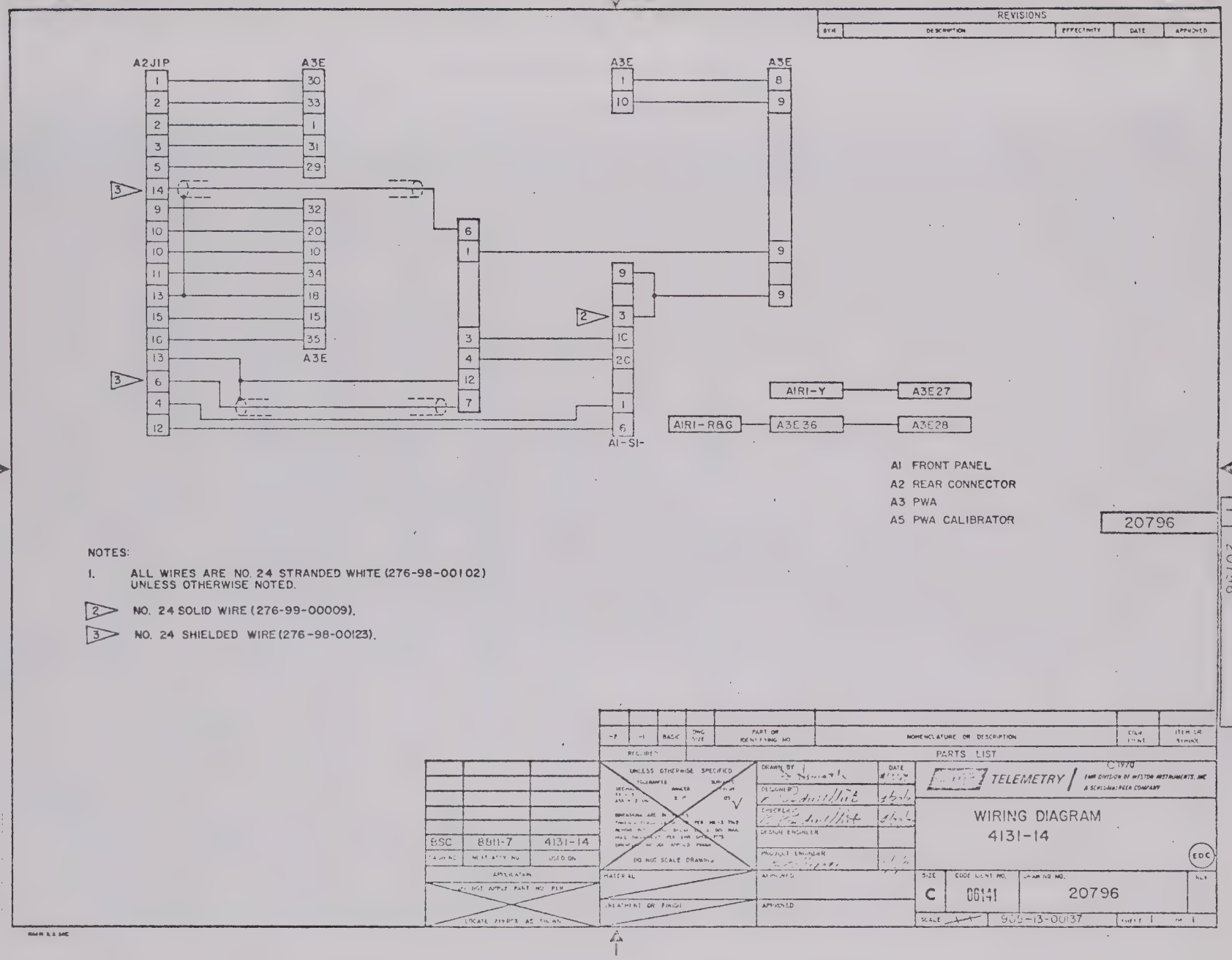


Figure A-8. Model 4131-14 Wiring Diagram

Table A-1. Divider Stages Used and Center Frequencies

CHANNEL CENTER FREQ. (Hz)	Z1		Z2		Z8		Z9		Z10		DIVIDER OUTPUT
	A	B	A	B	A	B	A	B	A	B	
150,001 - 300,000	X										÷ 2
*80,000 - 150,000	X	X									÷ 4
37,501 - *80,500	X	X	X								÷ 8
18,751 - 37,500	X	X	X	X							÷ 16
9,376 - 18,750	X	X	X	X	X						÷ 32
4,688 - 9,375	X	X	X	X	X	X					÷ 64
2,474 - 4,687	X	X	X	X	X	X	X				÷ 128
1,172 - 2,473	X	X	X	X	X	X	X	X			÷ 256
603 - 1,171	X	X	X	X	X	X	X	X	X		÷ 512
300 - 602	X	X	X	X	X	X	X	X	X	X	÷ 1024

NOTES:

1. Deviations available are standard ±7.5% and ±15% PBW; ±1 kHz, ±2 kHz, and ±4 kHz CBW.
2. * The 37,501 to 80,500 Hz range is used for a 70 kHz ±7.5%/±15% channel.
   The 80,000 to 150,000 Hz range is used for a 80 kHz ±1 kHz/±2 kHz/±4 kHz channel.

Table A-2. Jumper Wiring

DIVIDER FROM TABLE A-1	TERMINAL JUMPER WIRING																	
	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO
÷ 2	E9	E14																
÷ 4	E9	E8	Z2-10	E14														
÷ 8	E9	E8	E11	E14														
÷ 16	E9	E8	E11	E10	E5	E14												
÷ 32	E9	E8	E11	E10	E5	E37	E39	E14	E2	E47	E13	E40						
÷ 64	E9	E8	E11	E10	E5	E37	E39	E38	Z9-10	E14	E2	E47	E13	E40				
÷ 128	E9	E8	E11	E10	E5	E37	E39	E38	E42	E14	E2	E47	E13	E40				
÷ 256	E9	E8	E11	E10	E5	E37	E39	E38	E42	E41	Z10-10	E14	E2	E47	E13	E40		
÷ 512	E9	E8	E11	E10	E5	E37	E39	E38	E42	E41	E44	E14	E2	E47	E13	E40		
÷ 1024	E9	E8	E11	E10	E5	E37	E39	E38	E42	E41	E44	E43	E45	E14	E2	E47	E13	E40

Table A-3. Model 4131-11 Parts List (Ref. Figure 7-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131-11 CALIBRATING CHANNEL SELECTOR	414-89-00053	06141	8811-4 (Rev. ___)	1		Price and delivery of recommended spares on request.
P1	REAR CONNECTOR, Recp., 16 Pin, R & P	063-98-00048	02660	26-4200-16S	1		
R1	FRONT PANEL POTENTIOMETER, 1K ±10%, 1W (Used for frequencies below 100 kHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER, 500 Ohms ±10%, 1W (Used for frequencies of 100 kHz and above)	201-98-00142	02660	2901-L-501M	1	1	
S1	FRONT PANEL SWITCH, Rotary, 2P, 5 Pos.	250-98-00121	81073	50CD36-01-2-ADJN	1		
	PRINTED-CIRCUIT CARD ASSEMBLY (Ref. Figure A-2)	205-89-00977	06141	10869	1		
	CHANNEL SELECTOR CARD ASSEMBLY (Used for frequencies below 5 kHz)	205-89-00983	06141	11429-1	1		
	The components on this card assembly are the same as listed in Table 7-4 except that the following components are added:						
Z8, Z9, & Z10	INTEGRATED-CIRCUIT (The quantity depends on the center frequency, see Table A-1)	046-16-00023	04713	MC778P	3	1	
	CHANNEL SELECTOR CARD ASSEMBLY (Used for frequencies of 5 kHz and above)	205-89-00980	06141	11432-1	1		
	The components on this card assembly are the same as listed in Table 7-5 except that the following components are added:						
Z8, Z9, & Z10	INTEGRATED-CIRCUIT (The quantity depends on the center frequency, see Table A-1)	046-16-00023	04713	MC778P	3		

Table A-3 (Cont'd.). Model 4131-11 Parts List (Ref. Figure 7-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	CALIBRATOR CARD ASSEMBLY (See Table A-6 for breakdown)	205-89-00976	06141	10867	1		Price and delivery of recommended spares on request.

Table A-4. Models 4131-12 and -13 Parts List (Ref. Figure 7-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131-12 CALIBRATING CHANNEL SELECTOR	414-89-00054	06141	8811-5 (Rev. ___)	1		Price and delivery of recommended spares on request.
	MODEL 4131-13 CALIBRATING CHANNEL SELECTOR	414-89-00055	06141	8811-6 (Rev. ___)	1		
P1	REAR CONNECTOR, Recp., 16 Pin, R & P	063-98-00048	02660	26-4200-16S	1		
R1	FRONT PANEL POTENTIOMETER, 1K ±10%, 1W (Used for frequencies below 100 kHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER, 500 Ohms ±10%, 1W (Used for frequencies of 100 kHz and above)	201-98-00142	02660	2901-L-501M	1	1	
S1	FRONT PANEL SWITCH, Rotary, 2P, 5 Pos.	250-98-00121	81073	50CD36-01-2-ADJN	1		
	PRINTED-CIRCUIT CARD ASSEMBLY (Ref. Figure A-2)	205-89-00978	06141	10869-1	1		
	CHANNEL SELECTOR CARD ASSEMBLY	205-89-00981	06141	13767-2 (Rev. ___)	1		
	The components on this card assembly are the same as listed in Table 7-6 except the following components are added:						
Z8, Z9, & Z10	INTEGRATED-CIRCUIT (The quantity depends on the center frequency, see Table A-1)	046-16-00023	04713	MC778P	3	1	
	CALIBRATOR CARD ASSEMBLY (See Table A-6 for breakdown)	205-89-00976	06141	10867	1		

Table A-5. Model 4131-14 Parts List (Ref. Figure 7-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4131-14 CALIBRATING CHANNEL SELECTOR	414-89-00056	06141	8811-7 (Rev. ___)	1		Price and delivery of recommended spares on request.
P1	REAR CONNECTOR, Recp., 16 Pin, R & P	063-98-00048	02660	26-4200-16S	1		
R1	FRONT PANEL POTENTIOMETER, 1K ±10%, 1W (Used for frequencies below 100 kHz)	201-98-00143	02660	2901-L-102M	1	1	
R1	FRONT PANEL POTENTIOMETER, 500 Ohms ±10%, 1W (Used for frequencies of 100 kHz and above)	201-98-00142	02660	2901-L-501M	1	1	
S1	FRONT PANEL SWITCH, Rotary, 2P, 5 Pos.	250-98-00121	81073	50CD36-01-2-ADJN	1		
	PRINTED-CIRCUIT CARD ASSEMBLY (Ref. Figure A-2)	205-89-00979	06141	10869-2	1		
	CHANNEL SELECTOR CARD ASSEMBLY	205-89-00982	06141	13767-3 (Rev. ___)	1		
	The components on this card assembly are the same as listed in Table 7-7 except that the following components are added:						
Z8, Z9, & Z10	INTEGRATED-CIRCUIT (The quantity depends on the center frequency, see Table A-1)	046-16-00023	04713	MC778P	3	1	
	CALIBRATOR CARD ASSEMBLY (See Table A-6 for breakdown)	205-89-00976	06141	10867	1		

Table A-6. Calibrator Card Parts List (Ref. Figure A-3)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	CALIBRATOR CARD ASSEMBLY	205-89-00976	06141	10867	1		Price and delivery of recommended spares on request.
C1 thru C3	CAPACITOR, Test Variable	304-00-00000	06141		3		
CR1	DIODE, Zener 16V at 15.5 ma	088-10-47451	JEDEC	1N4745A	1	1	
CR2 thru CR5	DIODE	088-10-41480	JEDEC	1N4148	4		
K1	RELAY, DPDT 26.5V, 1350 Ohms	219-98-00062	80294	3115H	1	1	
Q1 & Q2	TRANSISTOR, SI NPN, Switching	263-10-42750	JEDEC	2N4275	2	1	
R1	RESISTOR, 10K ±5%, 1/4W	616-02-10001	01121	RC07GF103J	1		
R2	RESISTOR, 2.0K ±1%, 1/10W	608-09-20000	06141	624	2		
R3	RESISTOR, 5.6K ±5%, 1/4W	616-02-56000	01121	RC07GF562J	3		
R4	Same as R2						
R5 & R6	Same as R3						
R7 & R8	RESISTOR, 100 Ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	2		
R9	RESISTOR, 1K ±5%, 1/4W	616-02-10000	01121	RC07GF102J	1		
Y1	CRYSTAL, Frequency Variable	999-01-00001	06141	10870	1	1	
Y2	CRYSTAL, Frequency Variable	999-01-00002	06141	10870	1	1	
Z1 & Z2	INTEGRATED CIRCUIT	046-16-00023	04713	MC778P	2		